ELECTRICAL REVIEW

VOL. CLII 6th FEBRUARY, 1953 No. 6

Managing Editor: HUGH S. POCOCK, M.I.E.E. *Technical Editor:* W. O. FENWICK, M.I.E.E.
Industrial Editor: J. H. COSENS *Technical Consultant:* C. O. BRETTELLE, M.I.E.E.

IN THIS ISSUE

Contractors and Taxation	**287**
Dual-Purpose Domestic Heat Pump. By G. O. McLean, M.Eng.	**289**
Views on the News	**292**
European Co-operation	**293**
Modern Dairy	**294**
Electric Power Transmission Calculations. By W. T. Taylor, M.I.E.E., Fel.A.I.E.E.	**297**
Personal and Social	**300**
Water Power in Rhodesia	**303**
Industry and the House. By A. M. F. Palmer, A.M.I.E.E., M.P.	**306**
Parliamentary News	**307**
Engineering in Europe	**309**
Circuit Breaker Research	**311**
E.C.A. Dinner	**313**
Correspondence	**315**
Record Canadian Development	**317**
Commerce and Industry	**319**
New Books	**324**
Manufacturing Progress, 1952	**325**
Electricity Supply	**327**
Recent Introductions	**329**
Financial Section	**330**
Next Week's Events	**334**
New Patents	**335**
Contract Information	**337**
Classified Advertisements	**125**
Index to Advertisers	**140**

EDITORIAL, ADVERTISING & PUBLISHING OFFICES: Dorset House, Stamford Street, London, S.E.1. Telegraphic Address: "Elecrev, Sedist, London." Code: ABC. Telephone No. Waterloo 3333 (60 lines). Entered as Second Class Matter at the New York, U.S.A., Post Office. Annual Subscription: Home and Overseas £3 6s 0d: U.S.A. and Canada $11.00. Cheques & P.O.s (on Chief Office, London) payable to ELECTRICAL REVIEW PUBLICATIONS LTD., and crossed "Lloyds Bank."

They'll want a **BERRY** fire this weather!

Here is a neat new Panel Heater —No. 606— which will keep the weather at bay in many a modern room. It needs neither flue nor air duct, and can be fitted without damage to the wall.

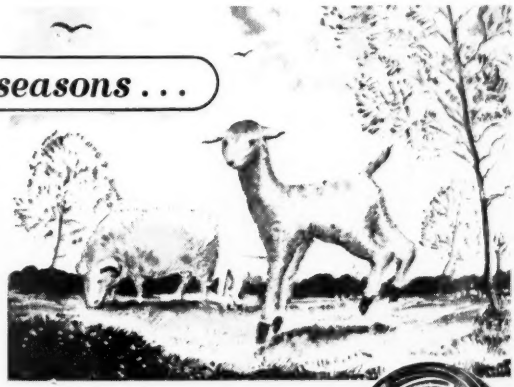
No. 606 Panel Heater (2 kW. Heating) is stove enamelled Cream with polished rustless radiant heat reflectors. Full heat control is provided by two recessed switches. The radiator is fitted with a special Safety Guard and complies in all respects with the latest B.S. specification.

Berry's ELECTRIC LTD

BERRY'S ELECTRIC LIMITED · TOUCHBUTTON HOUSE · NEWMAN STREET · LONDON · W.1

the changing seasons . . .

With unfailing regularity spring's magic wand is waved . . . the lambs gambol . . . the buds break through . . . life returns to the countryside. Not magic — but intensive development allied to sound engineering knowledge — accounts for the unfailing reliability of the Sangamo Solar Dial Time Switch as, with the changing seasons it automatically compensates for the changing times of sunrise and sunset. Details and prices will gladly be sent on application.



SANGAMO *Time Switches*

SANGAMO WESTON LIMITED, ENFIELD, MIDDLESEX

TELEPHONE : ENFIELD 3434 (6 LINES) AND 1242 (4 LINES) GRAMS : "SANWEST, ENFIELD"

London Office : St. George's Court, New Oxford Street, W.C.1 Telephone : CHAncery 4971

Branches : Glasgow (Central 6208), Manchester (Central 7904), Newcastle (Newcastle 26867), Leeds (Leeds 30867), Liverpool (Central 0230), Wolverhampton (Wolverhampton 21912), Nottingham (Nottingham 42403), Bristol (Bristol 21781), Southampton (Southampton 3328), Brighton (Brighton 28497)

ELECTRICAL REVIEW 6th FEBRUARY, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. CLII • NO. 6

Contractors and Taxation

A NOTEWORTHY aspect of the speeches at last week's annual dinner of the Electrical Contractors' Association was the absence of acidity in references to the British Electricity Authority (a term which embraces the Electricity Boards). It would seem that the doubts and fears engendered by the threatened extension of electrical installation activities upon the nationalization of the electricity supply industry have been dissipated to a great extent. Unfortunately both parties are working in a field which has been narrowed, largely as a matter of "policy" the reasons for which are no longer apparent. This has led them to a realization that their destinies are intertwined and, while they are competing for reduced business, they both know that they must get together for the protection of their industry. Adversity has made stranger bedfellows.

If electricity had continued to advance at its pre-war rate there would have been sufficient business for all, as will again be the case when a revival sets in—as it must. Eventually restraint becomes intolerable and the victim successfully struggles to set himself free. Thus it will be with the electrical industry but then the public mind will have to be freed from the prejudices which have been implanted by interested parties. A situation has been created by which many people who were avid for electricity have been convinced that electrical methods are in some way anti-social.

Restrictive purchase tax on electric heating, water-heating and other appliances has been a potent means of scaring people away from electricity. Mr. W. T. Trace, the E.C.A. president, was cautious in his claim for the removal or abolition of the tax for (as he said) regard has to be paid to the claims of industry as a whole. All the same there is a special case for certain electrical appliances which have been inequitably treated. Prominent among the inequities is the different rate of tax on some gas and electrical appliances to the disadvantage of the latter. This should certainly be straightened

out immediately. In referring to these matters, the president asked the Chancellor of the Exchequer to protect retailers from the loss which they suffer when purchase tax is removed or reduced and they are left with tax-paid goods.

But of course purchase tax is only one part of the general burden of taxation which is crushing industry and Mr. Trace joined with Lord Balfour of Inchrye (the principal guest) in calling for substantial relief—relief which can only be afforded if the Government reduces its unproductive expenditure. The need of industry is for new and more efficient tools of production. Present rates of taxation, coupled with inadequate depreciation allowances, preclude the replacement of obsolescent plant by equipment of up-to-date design which is essential if we are to be competitive in overseas markets. The electrical industry is deeply concerned in this matter in two ways. First it needs the relief itself to be able to provide replacements and secondly much of the improvement in the equipment of industry in general must mean greater electrification.

STANDARD MINING GEAR

In view of the vast range of purchases with which supply officers of the National Coal Board have to deal, any simplification of requirements that can be brought about by more standardization of equipment and component parts should be advantageous both to the industry and those manufacturers who are associated with it. The first set of standard specifications to be issued by the N.C.B. are now generally available; six of them deal with flameproof electrical equipment while the seventh deals with an electrically welded component. These new specifications, formulated in association with the British Standards Institution, will not only provide immediate guidance to users of mining gear, but should also forewarn engineers in general and mining men of the trends of N.C.B. purchasing requirements and practice.

AFRICAN WATER POWER

Among the countries within the British Commonwealth one with the greatest potentialities is the territory comprising Northern and Southern Rhodesia. To secure the most fruitful results more power is needed and British consulting engineers have drawn up two schemes for the development of hydro-electric resources. The first, reported on about two years ago, envisaged the harnessing of the Zambesi at the Kariba Gorge to produce ultimately 1,000 MW at a cost of £75·15 million. Now the same group has presented a report to the Northern Rhodesian Government for developing about 240 MW from the Kafue River in Northern Rhodesia at a cost (including transmission) of £27·6 million. The scheme is dealt with in this issue.

" MONOPOLY " ADVERTISING

Is it necessary for a monopolistic public body to advertise? The answer given in a lecture recently by Mr. R. J. Gregg, publicity manager to the Gas Council, is in the affirmative, particularly when the business is not a monopoly. This means that although the Gas Council and the British Electricity Authority and their " lower formations " have no rivals in their own fields they are themselves rivals. Each considers that it has the means of providing better conditions for the public and each can only reduce its prices by selling more of its commodity. Consequently both have the right to acquaint the public with the merits of gas or electrical methods and it is for the public to choose between them. Expenditure on advertisement by national boards is no more wasteful than that of private undertakings which has the same purpose—greater sales.

Dual-Purpose Domestic Heat Pump

Successful Tests at Bristol

By G. O. McLEAN, M.Eng.*

WHEREAS the advantages of heat pumps have been recognized for a considerable time and a post-war bibliography (see E.R.A. Report Y/T7) listed 89 technical articles on the application of the heat pump, commencing with Lord Kelvin's paper to the Glasgow Philosophical Society in December, 1852, it was felt up to the last few years that the equipment was too expensive for any application in domestic premises other than space heating for large houses where a suitable low grade heat source was available.

Mr. P. Sporn, in America, has sponsored work on small heat pumps for hot water in domestic premises and he has published† some results of his company's experiments. The E.R.A. has also considered this problem and laboratory tests are being carried out to determine the efficiency figures, using the air (presumed to be a kitchen larder) as the low grade heat source.

The author commenced similar experiments two years ago with a patched-up scrap domestic refrigerator unit and found that to achieve satisfactory performances the compressor and condenser had to be immersed in the water of the storage tank. Eventually a modern domestic refrigerator unit of the sealed type was provided by the Refrigerator Division of the English Electric Co., Ltd., and, after a preliminary test run in the laboratory, the equipment was installed in Electricity House, Bristol, so that practical tests could be carried out.

Description of Apparatus

The equipment, seen in Fig. 1, consists of a standard English Electric ½ h.p. compressor unit with a condenser coil consisting of about 27ft of $\frac{5}{8}$in copper tube wound round the outside, of a diameter of approximately 14in. The evaporator (B) is a standard gilled copper tube type (76 sq ft) standing on its own feet in an enclosed space constructed to represent an average domestic larder. The refrigerant used (Freon 12) is

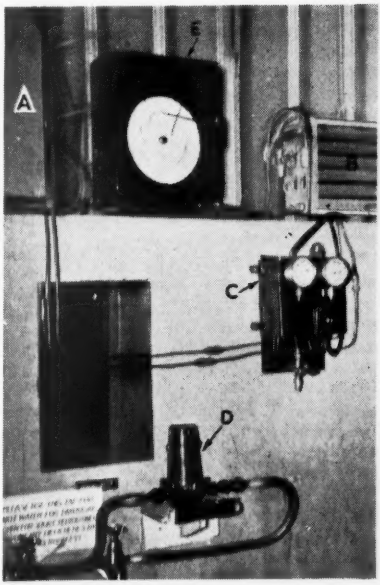


Fig. 1—The heat pump under test at Bristol

supplied to the evaporator by means of a constant pressure expansion valve. The difference between evaporator and condenser temperatures involves an appreciable pressure difference, and it was found necessary to fit a solenoid operated equalizing valve (behind control unit C) between the high and low pressure sides of the refrigerant circuit to permit easy starting and control of the compressor motor by a thermostat in the water storage tank.

The whole compressor unit is submerged in a 10 gall cylindrical tank which is insulated with about 2in of granulated cork (box A). Water (D) and electricity meters and recording thermometers (E) at each salient point are connected in the appropriate circuits to enable performance ratios to be calculated.

A few days' run when the hot water was used during office hours in three wash

* Chief Engineer, South Western Electricity Board.
† *Electrical World*, 27th February, 1949.

basins was sufficient to demonstrate that an output of over 30 gallons of hot water at a reasonably high temperature was a practicable proposition. Various tests were then carried out to determine radiation losses and the water equivalent of the mass of metal inside the storage tank, so that performance ratios could be worked out. This was followed by 24-hour tests when the water drawn off was fixed in quantity and time to simulate the consumption of an average domestic premises.

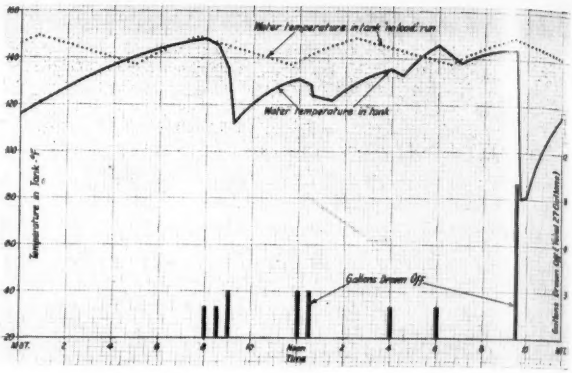


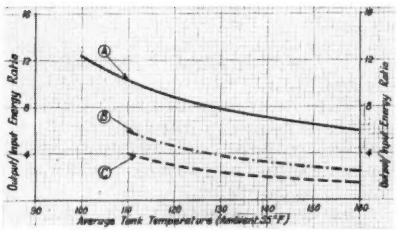
Fig. 2—Temperature variation with draw-off of water

The effect of drawing off quantities of water at stated times is shown clearly in Fig. 2, which also shows a no-load run of 24 hours with the tank thermostat set at 140 deg F after the initial heat insulation had been improved to reduce radiation losses.

This chart shows clearly that, except when a large quantity, such as 10 gallons for a bath (at 9 p.m. on the chart) is drawn off, the tank temperature never drops much below 120 deg F. Since the average use for a household is about 25 gallons (National Building Report No. 14 gives a weighted average of 6·6 gallons per head per day), it would appear that a small domestic refrigeration unit used as a heat pump is about the right size for the dual purpose.

The chart also shows that for a thermostat setting of 140 deg F the electrical load factor is approximately 45 per cent on a no-load run and 100 per cent on the run when 27 gallons was drawn off in 24 hours.

Fig. 3—Plant performa nce curves



Space limitation precludes the presentation of all the test results in tabular form, but a clear indication of the output/input performance ratios can be obtained from Fig. 3. This curve shows at A the theoretical maximum ratio obtainable with a perfect heat engine working on the Carnot cycle while curve B shows the average gross performances obtained at the various average tank temperatures. This ratio is the heat output at the condenser divided by the electrical input through the driving motor. Stratification in the tank made temperature readings difficult and the plotted results well scattered. Curve C is the net ratio measured by the rise in temperature of the water actually used each day, again divided by the electrical input.

This chart shows that with a modern sealed compressor unit and taking advantage of the friction losses by immersing the unit in the tank, the gross performance ratios are between 50 per cent and 60 per cent of the theoretical Carnot cycle figures. The difference between curves B and C is dependent on the quantity and quality of the insulation material round the storage tank and on the pipework from the tank to the point of use. It should be a practicable and economic proposition to make the curve C figures, say, half the value of curve B figures.

The results outlined above would lead one to the conclusion that it would be in everyone's interests (manufacturers, consumers and Area Boards) to press on with

the manufacture and sale of dual-purpose heat pumps because (*a*) the market is likely to be a better one than for refrigerators alone; (*b*) consumers would obtain virtually two appliances for the price of the more expensive one, with running costs considerably lower than the aggregate of two separate appliances; and (*c*) Area Boards would obtain the highest load factor appliance so far used by domestic consumers.

There are one or two points to be set against this optimism, but none of them appears insuperable. It is not certain that all modern refrigerator units are submersible, and water leakage into either the motor or compressor may lead to heavy maintenance costs, to say the least. Freon leakage from the compressor into the water may also cause trouble, since it must be remembered that Freon (CCl_2F_2) contains chlorine which reacts to form hydrochloric acid.

There are also the questions of anti-corrosive treatment for the metal parts immersed in the water and the effects of scaling on the condenser tube in hard water districts. The critics will also point out that, since the air in one small room of a house is the low grade heat source, it follows that this heat must come from the house itself, which may mean increasing the size, or at least the consumption, of the heating appliances in adjacent rooms. The author's reply would be that the normal opening of the larder door would allow all the heat input to the larder necessary, and the effect on the house heating would be no more noticeable than the presence of a large refrigerator in a modern kitchen.

Notwithstanding the difficulties to be overcome, it is felt that the case has been made for further practical tests in different parts of the country in actual homes of, say, Area Board employees where hot water systems are suitable for the installation of the compressor unit, and where instruments could be installed and read. It is suggested also that the experiments should include tests with larger sized units and larger storage cylinders, so that the hot water can be used for the base load heating of part, or the whole, of the house. This could call for co-operation between plant manufacturers and Area Boards, with help from the E.R.A. with regard to instruments and co-ordination of results, but it appears to be a piece of co-operative research that is well worth doing *now*.

In conclusion, the author wishes to tender his thanks to the English Electric Co., Ltd., for the loan of plant, the E.R.A. for instruments, and his own Board and staff for facilities provided and valuable help in carrying out the experiments.

Diesel Engine Manufacture

THE Stockport works of the diesel engine manufacturers Mirrlees, Bickerton & Day, Ltd., has been undergoing a major reorganization and when we visited this plant last week we saw that the work has been almost completed. The factory covers an area of about 300,000 sq ft and since 1946 almost 90 per cent of the machine tools and equipment have been renewed, individual motor drives having been provided for all machines instead of the old-fashioned belt drive from overhead line shafting.

Originally the range of engines made involved the manufacture of ten different sizes of cylinders. Now only two sizes are made, there being only two main types of engine produced; these are "J" and "K" type engines which are being made as vertical in-line and V-type engines. They are supplied naturally-aspirated, pressure charged and high pressure charged with air intercoolers. They are designed to meet the growing trend for power units compact in size, while maintaining the essentials of low piston speeds, robust construction and accessibility.

The smaller of the series, the "J" and "JV" type engines, have a 9·75in bore and a 10·5in stroke, and are suitable for speeds up to 1,000 r.p.m. They are built in a number of sizes from three to sixteen cylinders and cover a power range of from 165 b.h.p. to 2,500 b.h.p. The "K" and "KV" engines have a bore of 15in and a stroke of 18in and are built in sizes from five to twelve cylinders and the "KVSS12" high-pressure turbo-charged engine is claimed to be the most compact power unit of its type. These engines are suitable for speeds up to 450 r.p.m. and powers from 485 to 3,000 b.h.p. The pistons are oil cooled.

Before the reorganization took place in 1945 the annual production rate was worth £675,455, but by 1952 this had risen to £4¼ million. The planning for this year is £6 million. The orders at present in hand total over £12 million in value.

VIEWS on the NEWS

By REFLECTOR

JOHN GORDON of the *Sunday Express* recently attacked Lord Citrine, chairman of the B.E.A., upon the appointment of a divisional controller who was not a member of any of the leading engineering institutions (or " institutes " as the writer termed them). One would not bother about it except for the fact that in a subsequent issue it was stated:

> " Significantly not one of the trade papers of the industry discusses the subject, although it is the sole topic of talk in the industry. Why? Because Lord Citrine is almost the sole dispenser of advertising. He could wipe them out if they offended him."

This laughable assertion provides a measure of the irresponsible and ill-informed nature of so much of what finds its way into the popular Press.

* * *

Electricity consumers in several parts of the country are reacting fairly vigorously against rises in charges. This is not, however, what worries the chairman of the Eastern Gas Consultative Council. His complaint is that for domestic cooking and heating, at least, electricity charges are too low. If they were raised to an " economic " figure, he says in a memorandum presented to his Council, " this might result in gas being generally used for these purposes, and would enable the Electricity Board to conserve energy, avoid future load shedding, and secure a more economic use of coal." On what the chairman bases his premise I do not know, but it is certain that without the domestic cooking and heating load electricity charges would be much higher than they are at present.

* * *

Liaison is one of those very useful foreign words for which there is no exact single English one. Its use by us has been largely military; in France it too frequently has another connotation. But having accepted the word we ought not to overwork it and we certainly should not invent strange variants. Recently in an Electricity Board magazine I have seen a reference to somebody who, as a part of his job, " liaised " with somebody else. In an advertisement in the *Electrical Review* an electrical engineer is called for " capable of liaising site, consultants and works."

* * *

I have received a note from the Rumanian People's Republic reporting broadcasting progress. Since 1944, it says, new and powerful broadcasting stations have been built of a capacity fourfold those of 1944 and the number of radio subscribers has increased by 441 per cent. As is usual in these Eastern European statements the effect is nullified by the absence of any mention of the original figures upon which the increases are based. I am happy, though, to reproduce the phrase " technical equipment for radiofication centres " which appears in the report.

* * *

Many letters have recently appeared in the *Manchester Guardian* upon the filthy and generally unpleasant state of many railway stations in this country. The principal remedy put forward is a thorough change of heart in management and among employees. But it seems to me that keeping British Railways clean is a Sisyphean task while locomotives belch out great streams of grit-laden black smoke. Electrification would help here as in other directions.

* * *

A letter in the *Liverpool Daily Post* reads as follows:—

> " Could any of your readers inform me if remains of electric cables have ever been found during excavations on archæological surveys of ancient China, also approximate period of age, etc."

Well, the Chinese are said to have invented gunpowder, and the magnetic compass, among other things.

EUROPEAN CO-OPERATION

Electric Power Prospects

UNDER the title "Europe—the Way Ahead" the Organization for European Economic Co-operation (2, rue André-Pascal, Paris, 16e) surveys its fourth year of activity. This 358-page volume is in three parts: the first outlines a programme of action to achieve solvency in Western Europe and the strengthening of member countries' economies; Parts II and III analyse the present economic situation of member countries and of the United States and Canada. In Part II there are forecasts of economic development in these countries up to the middle of 1954 with indication of policy and Part III gives points on which Government action seems desirable.

Dealing with electricity supply, the report says that, on the basis of a study made by the Special Group for Electricity set up to consider the implications of the overall expansion programme, the Council established, for the year 1956, the objective of an electricity output of just under 352 billion kWh (billion = 1,000 million), compared with 254 billion in 1951; this implies an average annual increase in production of 7 per cent, or rather below the 9 per cent rate achieved in the years 1947–51. In 1952 satisfactory progress appears to have been achieved, with production probably some 7·2 per cent above the 1951 level, slightly higher than the average increase required in the years up to 1956.

Output Deficit

It appears likely that, despite a very considerable investment expenditure, output in 1956 will be limited to 344 billion kWh, the annual rate of increase averaging not more than 6 per cent and with a growing deficit between requirements and output. It may be expected that Switzerland and Austria will achieve an output rather in excess of their own requirements in 1956, but that the combined deficit of Italy and Germany will be very much greater. Although exchanges of electricity between countries may increase, it is not expected that maximum peak capacity in the interconnected countries will be sufficient to satisfy probable peak demand.

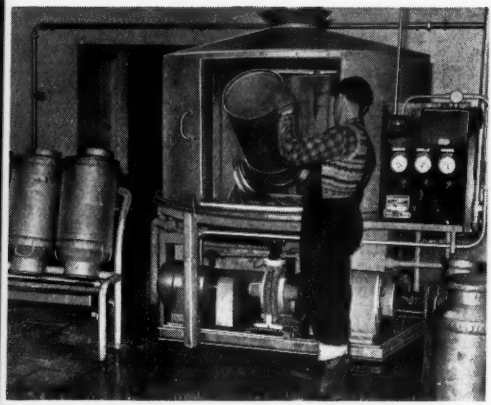
The probable increase in output is estimated on the assumption of median conditions for hydro-electric supply. Installed capacity in Western Europe as a whole is expected to rise at about the same rate for both thermal and hydro production, with the latter accounting for about 40 per cent of the total. If conditions were adverse for hydro-electric production, the deficit might rise from 8 billion to 27 billion kWh, and cause shortages which would seriously disturb industrial activity. In this case, there would also be a shortage of plant capacity of the order of 6,000 MW.

It is essential, says the Council, if the economic expansion of Western Europe is not to be delayed by a shortage of electric power, that sufficient plant and transmission networks should be available not only to meet requirements under normal conditions, but, within all practical limits, to provide an emergency reserve. Obsolescent plant should also be rapidly withdrawn.

Financial Problem

The major obstacle confronting the expansion of electricity supplies in member countries is financial. The total value of their present investment plans amounts to over $2 billion a year (at 1951 prices), of which two-thirds would be devoted to generating plants and one-third to distribution networks. The solution of the financial difficulties will depend partly on the effect of national price and tariff policies on the earnings of the electricity supply industry, a problem now being studied by the Organization. If the necessary finance is to be forthcoming, the possibilities of obtaining long-term loans must also be examined.

The possibilities of co-ordinating production and transmission of electric power in the various member countries must also be given further consideration. The progressive co-ordination of production and transmission would help to limit the increase in the real costs of electricity production which is to be expected as low-cost hydro sites are progressively exhausted and the rate at which efficiency of thermal plants can be improved slows down.



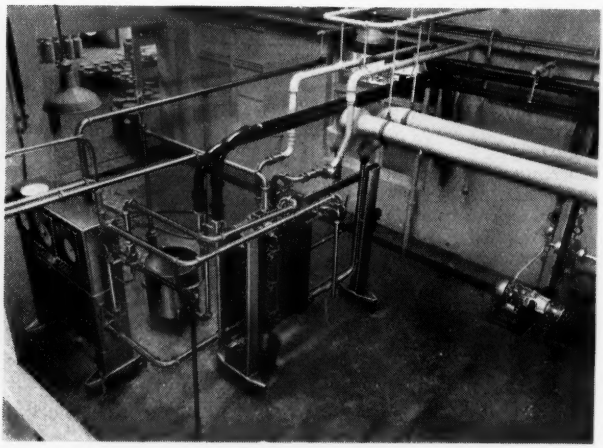
Modern Dairy

Electrical Plant for the Hygienic Pasteurizing, Processing and Bottling of Milk

EVERY precaution which electricity can provide to ensure the purity and quality of milk from dairy to consumer is taken at a dairy which Newcastle & District Dairies, Ltd., have established at Benton Park Road, South Gosforth. Built co-operatively by local dairymen to provide themselves with central "model" premises for use as their main supply depot, the dairy is designed to eliminate as far as possible manual operations and nearly 100 h.p. of electric motors have been provided to assist in the handling, pasteurizing and bottling processes.

The dairy began operating in January, 1952, and from the first day pasteurizing and bottling of milk took place without any difficulty or hitch. The existing capacity of the equipment is 1,500 gal/hour, with cold storage space for 8,500 gal of bottled milk in crates. There is some 13,000 sq ft of working floor space and, with the additional build-up of plant, the dairy is able to undertake a throughput of up to about 4,500 gallons an hour.

Milk arriving in churns or by tank vehicle is pumped direct to a 3,000 gal raw milk storage tank by means of a centrifugal A.P.V. pump. Milk in churns is first weighed before being similarly pumped from the receiving tank to storage. Every churn, after emptying, is thoroughly washed and sterilized on a semi-automatic machine driven by a 4 h.p. 1,440 r.p.m. Brook motor and capable of handling 2 or 3 churns a minute.



Above: **Churns are washed and sterilized by this semi-automatic machine**

Left: **Pasteurizing plant: control panel on the left and one of the pumps on the right**

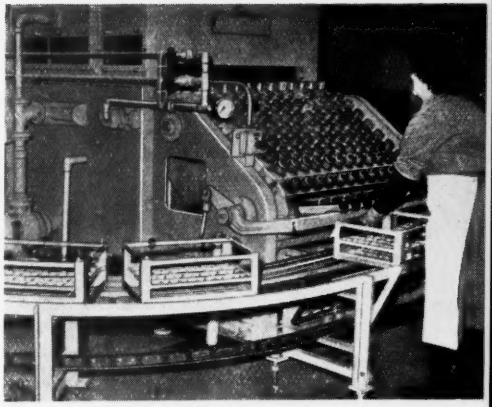
Right: **Exit end of the bottle washer and the filling and capping machine**

From the storage tank, where it is kept in a constant state of agitation, the raw milk flows to the balance tank of the pasteurizing plant. Pumped to the pasteurizer, the milk is raised to a temperature of 161 deg F at which it is held for 15 sec, being then cooled quickly to 40–45 deg F. Water chilled to a temperature of 36 deg F is used for the cooling, a regeneration system being incorporated in the scheme for economy.

Control of the A.P.V. Company's "Paraflow" "H.T.S.T." (high temperature short time) system of pasteurization employed is rendered practically foolproof by the provision of a Negretti & Zambra panel which indicates on recorders the temperature of the milk throughout its treatment, operation of the various pumps being shown by pilot lamps.

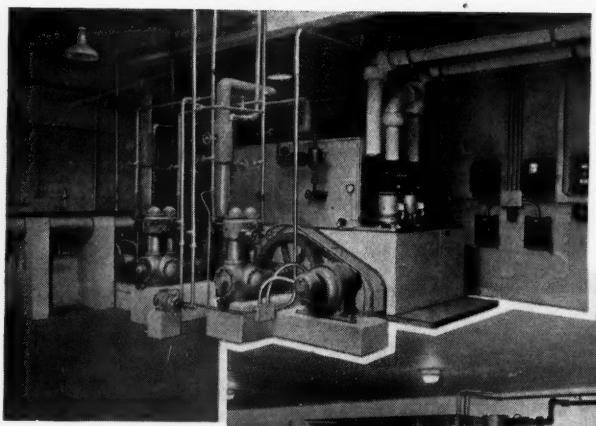
After cooling, the milk is pumped to a storage tank whence it flows to a Graham Enock "Cemac" bottle filling and aluminium capping machine which is fully automatic. Three motors of $1\frac{1}{4}$, 1 and $\frac{1}{4}$ h.p. respectively operate the driving mechanism, a vacuum device which prevents milk from entering damaged bottles, and mechanism which raises the bottles into the injection nozzles to receive the milk.

All bottles before filling are passed through an Auto Dairy Engineers' washing and sterilizing machine which gives high pressure caustic and hot water washing and rinsing both inside and outside. Besides a $1\frac{1}{2}$ h.p. driving motor this machine incorporates three 3 h.p. motors for operating the pumps. Power conveyors are provided not only for taking the clean bottles from the washer to the filling and capping machine but also for handling the crates. The same continuous unit brings the crates of empty bottles to the washer and carries away the crates of full bottles to the cold store.



Feeding in dirty bottles to the washing and sterilizing machine which can deal with 6,600 bottles an hour. The crates after being emptied are carried by the conveyor to the other end of the machine to receive the filled bottles and carry them to the cold store

This cold store, which has a capacity of 8,500 gal of bottled milk, is kept at a



The two ammonia compressors which serve the cold room and provide the chilled water for the pasteurizing plant

Crates of filled bottles are brought by conveyor to the cold room

temperature of 38 deg F by means of direct expansion air conditioning plant (York Shipley). The two ammonia compressors with their Brook 20 h.p. 1,440 r.p.m. motors are housed in an adjoining but separate engine room where are also installed the York Shipley pumps in duplicate for carrying the chilled water through the air conditioning plant and cooling section of the pasteurizing plant. The temperature of the cold room and of the chilled water supply for the pasteurizer is controlled by Maclaren thermostats operating in conjunction with G.E.C. relays. Two small Worthington Simpson motor-driven pumps arranged in duplicate are employed for the water cooling of the cylinder heads of the compressors. Also in the engine room is a Williams & James air compressor used for controlling the various processes.

In the boiler house, which supplies steam for churn and bottle washing, etc., is a Cochran solid fuel boiler fitted with a Prior stoker driven by a 4 h.p. motor.

The incoming electricity supply is brought in through a Revo main 200 A switch, which feeds a number of local distribution boards (M.E.M.) in the various departments. All the motors which are equipped with Allen West starters are supplied through M.E.M. isolators and switch fuses. The electrical contractors were Wilson & Ridley, Ltd., the plant and machinery being installed by the A.P.V. Co., Ltd.

The electricity supply is provided by the North Eastern Electricity Board, to whose staff and also that of the Newcastle & District Dairies, Ltd., we are grateful for assistance in preparing this article.

Glasgow Suburban Railways

THE Clyde Valley Planning Advisory Committee is asking the chairman of the British Transport Commission and the chairman of the Railway Executive to receive a deputation on the electrification of Glasgow's suburban railways as proposed in the Inglis Report. The Committee is also approaching the Scottish Council (Development and Industry), which has already approved the electrification project.

Electric Power Transmission Calculations

The Per Unit System

By WILLIAM T. TAYLOR, M.I.E.E., Fel.A.I.E.E.

THE per unit system has long been in general use for the analysis of the performances of rotating electrical machinery and power transformers, but it is new to electric power transmission analysis which involves the ABCD general circuit constants, circle diagram work and stability problems. Per unit notation is based on ratios of unit 1, not percentages of unit 100; its base, or reference, value is taken as 1 and other quantities as decimals of 1.

The per unit system can lay claim to several advantages over commonly used methods for computing power transmission circuit performances. Per unit quantities are essentially of the same magnitude so that errors in placing decimals are minimized, troublesome coefficients are eliminated and the per unit quantities need not necessarily be extended beyond the third decimal for close accuracy. The per unit voltage does not change when power passes through an ideal transformer, hence the voltage levels can be compared directly though the base voltage may differ. The per unit basis of comparison is maintained with little or no risk of creating misleading results, and a simpler method of approach is made possible compared with the usual laborious whole-circuit formula.

Circuit Constants

High voltage long-distance overhead power transmission (design-performance-stability) analysis still favours the use of general circuit constants, computed by either infinite series expansions or hyperbolic theory. The ABC and D constants are the first per unit quantities to be computed. Constants A and D are invariable; the real or actual voltage is found by multiplying the per unit value by the base voltage E_b. The actual ohms value of constant B is found by multiplying the per unit value by the base impedance z_b, and the actual mhos value of constant C is found by multiplying the per unit value by the base admittance y_b. Constant D occurs when combining two or more series circuits having different impedance and admittance quantities. Over-all A′B′C′D′ constants arise in circle diagram and stability work.

Application of Method

As the per unit system can be best understood by practical illustration, assume the following transmission line characteristics:

$r = 0{\cdot}2921$ ohm/mile
$x = 0{\cdot}6354$ ohm/mile
$x_c = 4{\cdot}665 \times 10^{-6}$ mho/mile
$z = 0{\cdot}2921 + j0{\cdot}6354 = 0{\cdot}6993 \ @ \ 65°19'00''$ ohm/mile
$y_c = 0{\cdot}000 + j4{\cdot}665 \times 10^{-6} = 4{\cdot}665 \times 10^{-6} \ @ \ 90°00'00''$ mho/mile.

The characteristic (natural) impedance:

$$z_o = \sqrt{z/y} = \sqrt{(0{\cdot}6993 \ @ \ 65°19'00'')/(4{\cdot}665 \times 10^{-6} \ @ \ 90°00'00'')} = 387{\cdot}2 \ @ \ -12°20'30'' \text{ ohms.}$$

The above primary characteristics are all that is required to start the ABC constants.

Now select the base voltage and base power: let $E_b = 132$ kV and $P_b = 50$ MVA. The three principal secondary base quantities are then given by:

$z_b = 132^2/50 = 348{\cdot}48$ ohm/mile
$y_b = 1/348{\cdot}48 = 0{\cdot}000287$ mho/mile
$I_b = 1{,}000 \times 50/132\sqrt{3} = 218{\cdot}69$ amps.

The per unit (p.u.) quantities now commence with z′ and y′ and continue through to the end of the problem. Thus:

$z' = (r + jx)/z_b = (0{\cdot}2921 + j0{\cdot}6354)/348{\cdot}48$
$= 0{\cdot}000838 + j0{\cdot}001823$ (per unit ohm/mile)
$y' = (g + jx_c)/y_b = (0{\cdot}000 + j4{\cdot}665 \times 10^{-6})/0{\cdot}000287$
$= 0{\cdot}000 + j0{\cdot}001625$ (per unit mho/mile).

For any length of line s, in miles; say, 200 miles:

$Z = sz' = 200(0{\cdot}000838 + j0{\cdot}001823) = 0{\cdot}1676 + j0{\cdot}3646$ (per unit ohms)

$Y = sy' = 200(0{\cdot}000 + j0{\cdot}001623) = 0{\cdot}000 + j0{\cdot}3250$ (per unit mhos)

And $z_0 = z_b\sqrt{Z/Y} = 387{\cdot}2 \text{ @ } -12°20'30''$ ohms, the natural impedance.

Knowing the above quantities, the transmission line ABC constants are then computed by means of the infinite series expansions because the above-mentioned primary characteristics represent all the preliminary data required.

For primary base quantities we have the choice of E_b P_b and E_b I_b. The former should more generally take preference because the base current I_b can be the cause of a lot of confusion and should be avoided as much as possible. The most useful per unit formulae for power transmission work are:

$I_b = 1{,}000(E_b/\sqrt{3})y_b = 1{,}000 \times (132/\sqrt{3}) \times 0{\cdot}00287 = 218{\cdot}69$ amps

$= P_b(E_b/\sqrt{3})E_b^2 = 50 \times (132/\sqrt{3})/17{,}424 = 218{\cdot}69$ amps

$= 1{,}000(E_b/\sqrt{3})/z_b = 1{,}000 \times 132/\sqrt{3}) \times 348{\cdot}48 = 218{\cdot}69$ amps

$= 1{,}000\ P_b/E_b\sqrt{3} = 1{,}000 \times 50/132 \times \sqrt{3} = 218{\cdot}69$ amps

$E_b = (z_bI_b\sqrt{3})/1{,}000 = (348{\cdot}48 \times 218{\cdot}69 \times \sqrt{3})/1{,}000 = 132$ kV

$= 1{,}000\ P_b/I_b\sqrt{3} = 1{,}000 \times 50/218{\cdot}69 \times \sqrt{3} = 132$ kV

$P_b = (E_bI_b\sqrt{3})/1{,}000 = (132 \times 218{\cdot}69 \times \sqrt{3})/1{,}000 = 50$ MVA

$= E_b^2/z_b = 132^2/348{\cdot}48 = 50$ MVA

$= E_b^2y_b = 132^2 \times 0{\cdot}00287 = 50$ MVA.

For the above mentioned transmission line the computed ABC constants are:

$A = 0{\cdot}9412 + j0{\cdot}0267 = 0{\cdot}94145 \text{ @ } 1°37'30''$ (in per unit)

$B = 0{\cdot}1611 + j0{\cdot}3589 = 0{\cdot}3934 \text{ @ } 65°50'00''$ (in per unit)

$C = 0{\cdot}00289 + j0{\cdot}3186 = 0{\cdot}3187 \text{ @ } 90°31'00''$ (in per unit)

The expression $z_b\sqrt{B/C} = z_0$ may be used for checking the accuracy of constants B and C; thus $\sqrt{B/C} = \sqrt{0{\cdot}3934/0{\cdot}3187} = 1{\cdot}1111 \text{ @ } -12°20'30''$ (in per unit); hence $z_b\sqrt{B/C} = 348{\cdot}48 \times 1{\cdot}1111 = 387{\cdot}2 \text{ @ } -12°20'30''$ ohms, which checks exactly. A complete check of all the constants is given by $A^2 - BC$; thus:

$(0{\cdot}9412 + j0{\cdot}0276)^2 - (0{\cdot}1611 + j0{\cdot}3589)(-0{\cdot}00289 + j0{\cdot}3168)$

$= 0{\cdot}999 + j0{\cdot}000$ (in per unit).

No advantage is gained and no time saved by converting the per unit auxiliary circuit constants to real values. The per unit values should be continued to the end of the problem; that is until the per unit E_s and I_s and P_s quantities are determined. To satisfy a personal interest they may be converted; thus, the real ABC constants in this case are:

$A = (0{\cdot}9412 + j0{\cdot}0267) \times 132 = 124{\cdot}238 + j35{\cdot}244$ (kV)

$= 0{\cdot}94145 \times 132 = 124{\cdot}27$ kV

$B = (1611 + j0{\cdot}3589) \times 348{\cdot}48 = 56{\cdot}14 + j125{\cdot}1$ (ohms)

$= 0{\cdot}3934 \times 348{\cdot}48 = 137{\cdot}1$ ohms

$C = (-0{\cdot}00289 + j0{\cdot}3186) \times 0{\cdot}00287 = -0{\cdot}0000083 + j0{\cdot}000914$ (mhos)

$= 0{\cdot}3187 \times 0{\cdot}00287 = 0{\cdot}0009146$ mhos.

Terminal Conditions

Continuing the problem for terminal conditions only, assume the receiver voltage $E_r = 0{\cdot}950 + j0{\cdot}000$ in per unit (which permits of a − 5 per cent tap) and that the receiver power P_r is 40 megawatts at unity power factor, which latter is obtained through synchronous condensers; then:

$P_r = (40 + j0{\cdot}000)/50 = 0{\cdot}800 + j0{\cdot}000$ (in per unit)

$I_r = (0{\cdot}800 + j0{\cdot}000)/(0{\cdot}950 + j0{\cdot}000) = 0{\cdot}842 + j0{\cdot}000$ (in per unit).

Sending-end voltage $E_s = AE_r + BI_r = 1{\cdot}0298 + j0{\cdot}32783 = 1{\cdot}080 \text{ @ } 17°39'30''$ (in per unit) so that $1{\cdot}080 \times 132 = 142{\cdot}6 \text{ @ } 17°39'30''$ kV (line-to-line).

And $100(E_s - E_b)/E_b = 100(142{\cdot}6 - 132/132) = 8{\cdot}0$ per cent drop in voltage.

Sending-end current $I_s = CE_r + AI_r = 0{\cdot}7952 - j0{\cdot}30515 = 0{\cdot}8459 \text{ @ } 20°59'30''$ (in per unit).

I_s leads E_s by 3°20′00″; hence, $\cos \phi_s = 0{\cdot}998$, or 99·8 per cent leading.

(Note.—Only the *per unit* I_r and I_s quantities have entered into these calculations, giving simplicity and freedom from error).

Sending-end power:

$P_s = (1{\cdot}0298 + j0{\cdot}32783)(0{\cdot}7952 - j0{\cdot}30515)$

$= 0{\cdot}9189 - 0{\cdot}5364 = 0{\cdot}9205$ (in per unit)

so that $(0{\cdot}9189 - j0{\cdot}05364)/50 = 45{\cdot}94 - j2{\cdot}932$ MVA (minus sign indicates leading p.f.).

Transmission efficiency:

$P_e = 40/45{\cdot}94 = 0{\cdot}86$, or 86 per cent.

Universally employed formulæ for

computing the general circuit constants and sending-end E_s and I_s are of the whole-circuit type, given in terms of E_r and I_r for finding E_s and I_s. In the case of a simple two station three-phase straight-through long-distance line including transformers with different characteristics and voltage taps, this type of formula is unwieldy and becomes more so when other impedances and admittances are added. Computations are liable to error, mathematical procedure is laborious and such formulæ are intended for and merely give the two terminal values. The simpler per unit formula gives both terminal and the most important intermediate voltages and currents and their angular displacement values.

Due to the fact that circuit and system power limitations are influenced in some way by the electrical characteristics of every piece of apparatus and equipment and machine connected thereto, it is advantageous to know both location and extent of every appreciable change in voltage, current and power. The per unit system facilitates direct dealings with every change in both voltage and loading, which may then be modified for best operation. For a two station straight-through transmission line (which is the most common) the whole-circuit formula is broken down in such a manner that voltages and currents are made known at such points of the circuit as the l.v. receiving-end bus, the h.v. receiving-end transformer terminals (with and without voltage taps), the h.v. sending-end transformer terminals (with and without voltage taps) and the l.v. sending-end bus.

Considerable advance has been recorded in the art of overhead high voltage long-distance power transmission since the advent of nation-wide electricity supply monopoly. Yet it is astounding that steps were not taken years ago to break down the design approach (carried out by whole-circuit formula) when dealing with long-distance transmission problems. There is also some doubt about the most correct design and stability loadings. Should it be a "maximum" load (if so, what maximum), natural load of the line itself, or the absolute "safe" load limit based on steady-state conditions as distinct from open-circuit short-circuit (accidental) power flows which may happen at any time and form part of the operating conditions that come under the heading of system stability and stability limit?

The open-circuit condition offers the most dangerous voltage rise and the short-circuit condition offers the most dangerous current rise; these two extreme (disturbing) operating conditions seem to offer the most satisfactory basis for carrying out circle diagram and stability work. The per unit system lends itself to a breakdown of the whole-circuit formula and a direct solution of circuit constants (over-all and composite) required for circle diagram and stability analysis.

Serving Small Townships

Oil-Engine Plant in Queensland

ELECTRICITY supply in Western Queensland, with its small townships of 250–1,000 people, has for some time been a problem to the State Electricity Commission. Earlier investigations came up against the difficulty of high cost. Recently the offer of Government subsidies up to 65 per cent has made it possible to meet the capital cost and specially designed plant which can be operated by one man has overcome the obstacle of high running costs. The outcome has been that in 1952 small power stations of this kind were brought into service at Quilpie, Isisford, Richmond, Taroom, Tara, Aramac, Julia Creek, Muttaburra, Jericho and Alpha.

Orders for prefabricated stations and for generating plant were each placed with one supplier. In consequence of this standardization, a "pool" of major replacements can be kept at a central point. The generating plant consists of single-cylinder 31 b.h.p. oil engines driving 16 kW compensated self-excited alternators, which were chosen as the most suitable for unattended running in parallel. Switchboards are of the open-panel type, efforts being made to keep the capital costs to the minimum.

The system of supply is 415/240 V three-phase, four wire, 50 c/s. Because of the small capacity of the plant care has been taken to obtain a balanced load condition; all motors above ½ h.p. are three-phase. For the present stoves, wash-boilers, welding sets and any other appliances of more than 2·4 kW or 3 h.p. are not allowed (except in the case of hospitals and water supply and sewerage systems where special arrangements are made with regard to the times of use). Modification of these restrictions may be possible in the light of operating experience. The tariff for domestic supplies is 1s 4¾d/kWh for the first 10 kWh a month, 7¾d/kWh for the next 20, 6d/kWh for the next 150 and 4½d/kWh thereafter. Commercial lighting charges range from 1s 4¾d to 10¾d and commercial power from 8½d to 4½d.

PERSONAL and SOCIAL

News of Men and Women of the Industry

IT is announced that **Mr. H. C. C. Keen,** A.M.I.E.E., formerly senior engineering assistant, Croydon District, South Eastern Electricity Board, has been appointed to the position of commercial manager, Newport District, South Wales Electricity Board, in succession to **Mr. E. W. Faithfull,** A.M.I.E.E., who has been appointed senior assistant (low voltage) in the Chief Commercial Officer's Department of the Board at St. Mellons. **Mr. M. F. Fry,** A.M.I.E.E., formerly assistant engineer, Luton District, Eastern Electricity Board, has been appointed a senior assistant engineer in the South Wales Board's Western Sub-Area.

Mr. G. S. Helme, T.D., A.M.I.E.E., manager in Scotland for Lancashire Dynamo & Crypto, Ltd., has retired after twenty-one years' service in that capacity. The company will, however, continue to use his services as a consultant. Mr. Helme was educated at the Royal Salford Technical Institute and the Royal Technical College, Glasgow. He joined the Trafford Park Works of Lancashire Dynamo & Crypto, Ltd., as an apprentice in 1906 and completed his training with Hick, Hargreaves & Co. In 1909 he went to Glasgow and for five years was a partner of Kelsall, Parsons & Co., at that time agents in Scotland for L.D.C. Mr. Helme served with the Royal Field Artillery (T.A.) for twenty-two years from 1914, retiring with the rank of major.

Mr. G. S. Helme

Mr. W. J. A. Gemmell, who has been in L.D.C.'s Scottish sales office since 1932, has been appointed to succeed Mr. Helme as manager for Scotland. He graduated (B.Sc.) from Glasgow University in 1924. During his university training and until 1925 he was a student apprentice in the L.N.E.R. Co.'s Glasgow Works and at the B.T.H. Co.'s Works, Rugby. For the next four years he was employed by a Glasgow company which merged subsequently with Allen West & Co., Ltd., and in 1929 became sales engineer and outside service engineer with Kelsall, Parsons & Co.

Mr. A. A. Millar, electrical engineer for the Cumberland area of the N.C.B.'s Northern Division, has been appointed chief electrical engineer to the Central West Area of the Scottish Division. Before nationalization of the mines Mr. Millar was chief electrical engineer (mining) for the Workington Iron & Steel Co. He takes up his new duties in April.

Mr. E. Sayers, who retired from the managership of the Aero and Auto Equipment Sales Department of the British Thomson-Houston Co., Ltd., at the end of January after forty-eight years' service with the company, started with the Meter Test Department in 1905. In 1910 he was transferred to the Supply Department, Rugby, which was then the organization handling the sales of meters and instruments, and in 1912 he went to various European countries, and to South America and Australasia, as foreign export representative specializing in electric meters, steam, water and air flow instruments, and Tirrell voltage regulators. This assignment was cut short by the 1914-18 war. At this time the decision was taken to discontinue the production of B.T.H. meters, and to concentrate the resources of the Coventry factory on the manufacture of high-tension magnetos for aircraft. Mr. Sayers was called on to take a share in this work, in both the Sales Department at Coventry and in the development laboratory, where he gave assistance on new magneto designs. In 1918 he became interested in accessories for aircraft and automobiles, and in 1932 was appointed manager of the Department now known as Aero and Auto Equipment Sales. He was selected to represent aircraft

Mr. E. Sayers

Mr. V. A. Higgs

accessory manufacturers when a party of British aircraft executives visited aircraft establishments in the United States and Canada in 1951. He is a Freeman of the City of London, and Liveryman of the Worshipful Company of Coachmakers and Coach Harness Makers.

Mr. V. A. Higgs, B. Sc. (Hons.), A.M.I.E.E., A.M.A.I.E.E., A.F.R.Ae.S., who succeeds Mr. Sayers as manager of the Aero and Auto Equipment Sales Department of the B.T.H. Co., has been assistant manager of the department since March, 1951. Mr. Higgs, who was born in London, obtained his early practical engineering training as a B.T.H. apprentice and his theoretical engineering training at the Northampton Engineering College, London University. After six years as a design engineer at Rugby, he was transferred to the B.T.H. Coventry works for work in connection with the windings of aircraft magneto, motor, and generator coils, etc. In 1941 he was appointed senior technical officer at the Ministry of Aircraft Production in London, and in 1946 returned to B.T.H., Coventry, Aero and Auto Equipment Department.

Mr. W. L. Wray, managing director of Wandleside Cable Works, Ltd., is to leave by air for South Africa on 7th February on a business tour. Besides the principal cities of the Union, he will visit also, on the return journey, the Rhodesias and East African territories. Mr. Wray is also chairman and managing director of the newly formed company, Irish Cables, Ltd.

Mr. G. Wardrop Fyfe, secretary of Telephone Properties, Ltd., has joined the board of the company.

Speaking at the festival dinner of the **Royal Commercial Travellers' Schools**, at the Trocadero Restaurant, London, W.1, last Friday, the Earl of Verulam (the principal guest) recalled that the Schools were founded by John Robert Cuffley over a hundred years ago. He commended the Schools for the way in which they were producing good citizens and said that they were committed to the expenditure of a six-figure sum to bring the buildings up to date. Each year £50,000 was needed to continue the work. Mr. J. Freeman Dunn (chairman, Board of Management) said that although the response to the appeal had been magnificent (a total of £42,750 was announced by the secretary, Mr. A. H. Carpenter) the Board was still anxious about the Schools' finances. Mr. Leslie Gamage (president of the Schools), in proposing the health of the appeal president (County Alderman C. Gordon Maynard), called upon the Schools' supporters to make Coronation year a record one. He announced that he proposed to make up this year's total to £43,000. Ald. Maynard responded and the other speakers were Mr. C. F. Bonser and Mr. J. R. E. Sharp.

Mr. J. B. Coates has been appointed an executive director of Berry's Electric, Ltd. After a switchgear apprenticeship Mr. Coates was engaged in design, commercial and production work with the English Electric Co., Ltd., and J. H. Tucker & Co., Ltd. He served with R.E.M.E. during the war and joined Berry's in 1950.

Mr. J. B. Coates

Mr. R. B. MacMorran has been appointed by Smiths English Clocks, Ltd., as assistant sales manager (electrical trade). He has represented the company in the Midland area and eastern counties and has had experience in many branches of the organization.

At the invitation of the chairman and directors, the staff at the Leyton works of the **London Electric Wire Co. & Smiths, Ltd.**, were entertained to a dinner and cabaret at the Tavistock Restaurant on 14th January. Mr. W. J. Terry, chairman of the company, welcomed his guests and Mr. A. J. Sands, technical engineer, proposed the toast of the company to which Mr. W. J. Terry replied. Among other head office executives present were Mr. G. E. Jewell and Mr. P. Kift. Mr. S. B. Klein, general manager of the Leyton works, was also present.

Simon-Carves, Ltd., announce that three of their directors, **Mr. D. T. Barritt, Mr. H. Clarke** and **Mr. J. P. V. Woollam**, have been appointed joint managing directors of the company.

Mr. D. T. Barritt

Mr. H. Clarke

Mr. J. P. V. Woollam

The annual dinner-dance of the West Yorkshire Branch of the **Electrical Contractors' Association** was held at the Grand Hotel, Harrogate, on 23rd January, and was attended by 360 members and friends in the industry. As in previous years the speeches were cut to a minimum, both in time and number. Mr. Moody, chairman of the North Midland Section of the I.E.E., proposed the toast to the E.C.A. and Allied Associations, and the response was made by Mr. J. R. Halliwell, vice-president of the Association. The chairman of the Branch, Mr. C. L. English, proposed the toast of the guests. Mr. R. H. M. Drake, president of E.I.B.A. and past-president of the E.C.A., in replying, appealed for support for the E.I.B.A. in the form of annual subscriptions. The amount collected by the Branch stands at present at £420, beating the record of 1947.

Flt.-Lt. E. W. C. Day, Associate I.E.E., informs us from Nairobi that after thirty-five years in the electrical industry he has decided to retire and settle in Natal. During his career Mr. Day served with the Barnes, Wimbledon and Fulham Corporations, Messrs. Handcock & Dykes and G. V. Twiss & Partners. After thirteen years with the Northmet Power Co. he was for ten years with the Air Ministry, serving in the Sudan, Sierra Leone, Ceylon and Kenya. His address is c/o Barclays (D.C. & O.) Bank, Ltd., West Street, Durban, Natal, South Africa.

Nearly 150 senior members of the staff of **E. K. Cole, Ltd.,** Electronics Division, and their wives and friends, attended a dinner and dance given by the directors in the works canteen at the Malmesbury, Wilts, factory on 23rd January. Mr. E. K. Cole, chairman and managing director, accompanied by Mrs. Cole, presided. Mr. and Mrs. N. C. Robertson were also present and Malmesbury executives included Mr. M. G. Hammett and Mr. E. Hudson. Responding to the toast of the company proposed by Mr. J. H. Kebby, personnel manager at Malmesbury, Mr. Cole said that the Malmesbury factory was playing an increasingly important part in the development of electronic equipment.

Mr. G. M. Baker has been appointed a director of C. A. Parsons & Co., Ltd.

The annual dinner of the **I.E.E. Radio Section** was held on 28th January at the Café Royal, London, W.1. The chairman of the Section, Dr. E. C. S. Megaw, presided and the principal guest was the president of the Institution, Colonel B. H. Leeson.

In his opening remarks the chairman welcomed the ladies and other guests and paid tribute to the support given by the Technical Press to the work of the Section. In a brief response, Col. Leeson mentioned the important part that would be played by radio and television at the Coronation.

Newman Industries, Ltd., announce a number of changes in their sales organization, electrical division. **Lt.-Col. E. A. Parr-Dudley,** T.D., A.M.I.E.E., hitherto London sales manager, takes over control and direction of home sales. **Mr. A. N. D. Kerr,** A.M.I.E.E., who, as previously reported, has resigned from the position of London manager for the Electrical Power Engineering Co. (Birmingham), Ltd., takes over the post of London sales manager. **Mr. A. C. Coad,** after five years with the London office, becomes manager of the Manchester office, while **Mr. V. P. Henderson,** senior London sales engineer for Hopkinsons, Ltd., has joined the London sales staff. **Mr. M. C. de Roemer,** a former sales engineer, who was called up in 1951 to serve as electrical officer on H.M.S. *Illustrious*, is returning to his original territory of Berkshire, Buckinghamshire, Hampshire, Wiltshire and Dorset.

In the South-Eastern Area contest in the Electrical Development Association's 1953 Public Speaking Competition, **Mr. W. W. Burke,** secretarial assistant at the South Eastern Electricity Board's headquarters, gained the first prize in the men's section, and the second place was taken by **Mr. D. J. Fuller,** a commercial assistant at the East Grinstead Service Centre. In the women's section the East Midlands and London Areas combined with the South-Eastern Area. First and second places were both gained by South Eastern Board employees, **Mrs. Joan M. Stanbrook** (Sutton) and **Miss Kathleen M. Barwell** (Redhill). Mr. A. W. Bonnell, A.M.I.E.E., showroom and trading superintendent, London Electricity Board, was chairman of both contests and the judges were Mr. C. F. Wells, chief commercial officer, and Mr. R. E. Gamlen, commercial section head, of the South Eastern Electricity Board, Mr. D. Rhys (Brighton) and Mr. J. A. Steadman, M.A., education officer, E.D.A.

OBITUARY

Mr. Arthur Stanley, formerly managing director and later a part-time director of Simon-Carves, Ltd., has died at his home at Deganwy, North Wales, at the age of eighty-seven. He commenced his career as an office boy with the company in 1883, was appointed secretary of the company in 1896, became a director four years later, and was appointed managing director in 1901. He held this position until his retirement thirty-five years later, but continued as a part-time director.

Mr. F. H. Starling, M.I.E.E.—The death is reported of Mr. Francis Henry Starling, who was chairman of Blackburn, Starling & Co., Ltd., electrical engineers, Nottingham, for fifty-four years. Mr. Starling was eighty-three years of age.

Water Power in Rhodesia

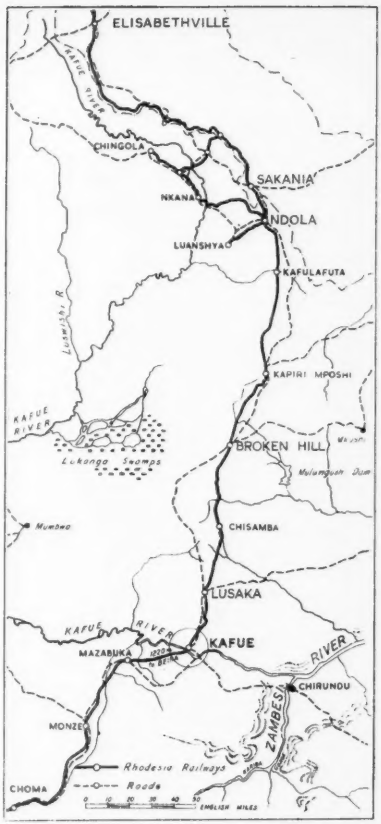
Development of Kafue River

IN view of large prospective developments in the copper mining industry, the Government of Northern Rhodesia invited Sir William Halcrow and Messrs. H. J. F. Gourley, C. H. Pickworth and Geoffrey Kennedy to report on a scheme for harnessing the Kafue River, a tributary of the Zambesi River. The report recommends an initial development based on a river discharge of 1,500 cusecs or 1,875 at 0·80 load factor giving 257 MW with a utilization of 0·99. The minimum output in the driest year would be 186 MW at that load factor. There would be two 172 MW stations, each containing four 43 MW sets, the upper one at the Keshya Ravine and the lower near the end of Kafue Gorge.

Storage of 100,000 acre-feet is obtainable by constructing a 600ft dam across the Gorge, giving an average gross head of 1,936ft. A tunnel of $13\frac{1}{2}$ miles and a capacity of 2,500 cusecs (3,125 at 0·80 load factor) connects the dam with the first power station.

The output from the two power stations would be taken to a central switching station and control centre near the upper station. Power would be transmitted at 220 kV south and north by single-circuit lines on lattice-steel towers to Norton in Southern Rhodesia and near Lusaka and N'Kana in Northern Rhodesia. The total capital cost is estimated at £27·6 million, of which £18·1 is in respect of generation. The estimated cost per kWh (99·4 per cent utilization) is 0·149d at the power station and 0·258d at the substations. At 186 MW of firm power, the corresponding costs are 0·205d and 0·355d.

The upper station is expected to be in full operation in $5\frac{3}{4}$ years and the lower station in $6\frac{3}{4}$ years from the date of the decision to proceed. The whole output of 257 MW could be disposed of as soon as the scheme came into commission, yielding a full return on capital expended. The completion of a scheme at Kariba, the subject of an earlier report, would enable its associated storage to be used for indirect regulation of Kafue, materially increasing the firm output of both.



The turbines would be Francis vertical shaft machines running at 428 or 500 r.p.m. coupled to vertical 11 or 15 kV alternators; the overall efficiency would be about 85 per cent. Auxiliary supplies would be obtained from two 1·5 MW horizontal impulse type turbo-alternators, one at each station, with the auxiliary switchboards interconnected to provide stand-by. The main alternators would be connected in pairs to three-winding step-up transformers, but with indoor 750 MVA circuit breakers on the lower-voltage side. Transport

limitations necessitate the use of single-phase transformers to form a three-phase bank. On-load tap-changing equipment would not be required.

The transmission system would be 220 kV, compared with 66 kV and 88 kV as now used in the Rhodesias, and is the same as that used for the supply from the Belgian Congo to the Copper Belt. An insulation level of 1,050 kV is recommended on the basis of a 1/50 micro-second wave; the slight increase above the I.E.C. value with solidly earthed neutral is on account of prevalent severe lightning storms. Arrestors should be installed at each substation on all incoming lines and, where locally desirable, at points half a mile from them.

Circuit breakers for 220 kV at Kafue should be rated at not less than 5,000 MVA to provide for future connection with Kariba. At the receiving end the minimum rating should be 3,500 MVA. Auto-reclosing mechanism and a by-pass switch should be used with each circuit breaker controlling a main transmission circuit.

Transformers at N'Kana and Norton would be 120 MVA banks (three single-phase units) with neutrals solidly earthed on the 220 kV side. A tertiary winding would be provided for 40 MVA hydrogen-cooled synchronous condensers for line regulation and these transformers would not be equipped with on-load tap-changing, but a 20 MVA three-phase unit at Lusaka would be so fitted with a voltage range of ±10 per cent. All transformers should be of the ON/OFB type.

High-frequency carrier phase-current comparison would be adopted for overhead line protection with back-up protection for both phase and earth faults. Transformers would have balanced quick-acting protection for all windings, with back-up over-current protection and stand-by earth fault protection, and would also be fitted with gas-operated relays.

Labour Requirements

An average labour force of 3,800 Africans and 230 Europeans would be required for the whole scheme including transmission. Allowing for illness the peak figures might rise to 6,000 and 360. The capital estimates include provision for permanent housing of staff (£130,000) and for temporary construction camps (£513,000) out of a total of £12,073,000 (including £1,413,000 as interest during construction) allowed for civil engineering works; the biggest item is tunnels and surge shafts (£5,858,000 followed by the Kafue dam (£1,096,000).

For mechanical and electrical plant, out of a total of £6,067,000 (including £649,000 interest during construction), turbines and alternators account for £3,053,000, transformers for £792,000 and switchgear for £397,000. The total power station capital cost works out at £52·7 per kW installed and £70·6 per kW of average output.

Capital expenditure on transmission amounts to £9,457,000 (including £783,000 interest during construction) of which the lines themselves cost £5,236. Switch stations, debited with £720,000 for transformers, £439,000 for switchgear and £314,000 for synchronous condensers, cost £1,813,000. Power factor correction, from 0·85 to 0·95, would cost a further £494,000.

Estimated Cost of Energy

Power station annual costs of energy sent out, £1,096,000, are made up of: interest, £816,000; sinking fund, £98,000; operation and management, £182,000. With an annual output at generator terminals, at 0·80 load factor, of 1,770 million kWh (average) and 1,284 million (firm), the cost per kWh sent out at 220 kV would be 0·149d average and 0·205d (firm).

Transmission annual costs of £716,000 cover: interest, £426,000; sinking fund, £101,000; operation and management, £189,000. The cost per kWh delivered, 1,682 million (average) and 1,225 million (firm), is stated as 0·258d and 0·355d.

Nine power systems are now operating in the Rhodesias—six thermal with a total capacity, existing and planned, of 236 MW and three hydro with 32 MW. Four stations supply the copper mines with 113 MW, which is expected to rise to 227 MW in 1960, when their capacity will be only 187 MW. Negotations are in hand for an import of 50 MW from the Belgian Congo for five years from 1957. Existing thermal stations are costly to operate because of a long haul of coal from the Wankie Collieries and the high cost of local wood. Some of these would, however, be retained to use steam from waste heat boilers and for load regulation. Estimated demands on the systems of the copper mining companies indicate that 93 MW in 1957 rising to 120 MW in 1960 could be accepted in addition to the 50 MW from the Belgian Congo.

Thus shortly after 1962 upwards of 200 MW, perhaps 250 MW if electric smelting becomes economic, would be needed by the copper mining companies.

In Southern Rhodesia a demand of 346 MW in 1960 is anticipated.

Mr. H. J. F. Gourley was prevented by illness from participating in the work and one of his partners, Mr. E. C. Steer, deputized for him. The panels records its appreciation of the work of Mr. B. D. Richards in connection with the report.

Flood Damage

Power Stations and Factories Affected

THE British Electricity Authority states that five of its generating stations were shut down during the early hours of Sunday morning as a result of the disastrous floods which occurred along the east coast and the banks of the River Thames during the week-end. At all of these stations flooding of the engine-room basements is reported. Loss of available capacity was as follows:—Deptford East, 90 MW; Littlebrook "A" and "B," 115 MW and 113 MW, respectively; Yarmouth, 14 MW; Ipswich, 14 MW; and King's Lynn, 5 MW.

Full availability of Littlebrook "A" was restored by Monday morning, and it is hoped that Littlebrook "B" will be in full operation by the end of the week. Two 25 MW sets at Deptford East were on load by Sunday evening and the remaining sets were expected to be available by Tuesday evening. Most of the plant at the other three stations was available for load by Monday morning.

Direct telephone communication with Littlebrook, West Ham, King's Lynn and Yarmouth ceased on Sunday. At Littlebrook radio-communication was established between the station and grid control. Messages were telephoned from Thames North grid control to the Area Board at Leyton from where they were passed to West Ham via the British Railways communications systems. From 10 p.m. on Saturday to 4 p.m. on Sunday all messages from control to King's Lynn power station had to be relayed through the Area Board. At Yarmouth communication was only possible with the aid of the section staff who had a car available.

Flooding occurred at Yarmouth 132 kV grid substation up to the level of the batteries as a result of which all automatic trippings are out of service. Attempts are being made to obtain a d.c. supply from the generating station. At Colchester the roof has been blown off the Area Board's 33 kV switch house.

Train Services Restricted

Owing to flooding at the Deptford East power station reduced train services similar to those adopted for fog had to be introduced on the British Railways Southern Region in its Eastern and Central Sections. This affected trains entering all the Region's London termini except Waterloo. The reduction in power available also made it necessary to cut off heating supplies in all electric trains in the affected sections. Normal services had been resumed by Tuesday morning but there were still restrictions on heating.

So far as can be ascertained about 125 telephone exchanges were put out of action by the storms. Of these 119 were in Scotland (where only one contained more than 100 lines), one in the North Eastern Region and five in the Home Counties. About 20,000 telephone subscribers' lines were out of order, 8,400 in Scotland, 7,500 in the Home Counties, 2,400 in the London Telecommunications Region, 1,350 in the North East Region, 600 in Northern Ireland and 400 in the Midland Region.

Cable Factory Out of Action

British Insulated Callender's Cables, Ltd., informs us that its Erith Works has been temporarily put out of action. The factory is on low-lying land and at 1.10 a.m. on Sunday the Thames breached the river wall and flooding started. About 1,000 workpeople and staff laboured all day to repair the damage but later there were further breaches. The water in the factory was 6ft deep in some places but there were no casualties. Efforts were made to salvage tools and materials and the electrical system is being gradually restored; the B.I.C. Construction Co. is overhauling the whole installation.

Orders have been diverted to the Prescot Works and elsewhere. Delays in deliveries will occur and customers have been notified. Offers of help were received from associated companies and competitors, some of which were gratefully accepted. At the time of our going to press the company was unable to make a definite statement regarding the resumption of work at Erith.

We are informed by J. Day & Co. (Derby Works), Ltd., that their works at Abbey Wood, London, S.E.2, were flooded out last week-end. Steps are being taken so that normal production may be resumed as soon as possible.

Industry and the House

Nuclear Energy Prospects

By A. M. F. PALMER, A.M.I.E.E., M.P.

I HAVE the feeling that white fish, apples and pears, furniture, Sunday observance and food prices have occupied more of our parliamentary time than industry and commerce since the Commons reassembled, but there certainly has been one matter of outstanding electrical interest for me to record. This was the announcement by the Minister of Supply that his Department was looking for a site on which to build a plant for the production of "substantial amounts" of electricity from atomic power.

Cautious Forecast

Apparently a small experimental reactor is now being built at Harwell and should be ready fairly soon. The full-scale plant is to be of the "breeder" type designed to give a surplus of fissile material. Mr. Sandys was cautious on the point as to whether electricity generation by atomic energy was likely in a reasonable period of time to rival seriously generation by conventional means. He contented himself with saying that *if* the technical problems still outstanding were solved and *if* the new methods proved to be economical then it was possible that "before long" an additional power source would be available.

None of this, of course, added much to what is known to most of us already, but it stimulated a few questions from those Members of Parliament who with uninhibited faith still regard the nuclear process as a modern Aladdin's lamp ready waiting to work strange wonders. Mr. Hector Hughes, for instance, wanted the Minister to tell him there and then when all would be set for making available nuclear power units of "a size, weight and price, appropriate for use in ships, on trains, in factories and in homes." Very reasonably, Mr. Sandys was not prepared to prophesy.

Later the same day the House probed into the scientific research activities of the Government in special fields. This was during the discussions on the supplementary estimates for the Ministry of Supply. On the whole Members took with surprising calm the announcement that the Ministry needs to spend many extra million pounds in connection with research on atomic energy, jet propulsion and guided rockets. Maybe this was because both sides of the House were ready to accept as fact Mr. Sandys' assurance that the extra money was asked for since progress had been unexpectedly rapid; our "know-how," and consequent defence preparedness, in these abstruse matters is said to be advancing at a comforting rate.

As a point of passing comment it is worth noting that the Minister regards the guided rocket as "a decisive instrument" likely "to dominate the military scene in the not-too-distant future." With that pointer to our possible future Members gladly let Mr. Sandys have his money.

Iron and Steel Bill

The Iron and Steel Bill, also in the charge of the ubiquitous Mr. Sandys, has entered the Committee stage; as with all legislation of principle in this Parliament, it is "on the floor" and not "upstairs." But the practical working out of the process is much the same as if the Bill were being examined in Standing Committee by a select few. Once Mr. Speaker has called the business the House, crowded at question hour, thins rapidly to the two score or so Members who make it their mission in life to follow the political ups and downs of this prince of metals. When dim centuries ago the primitive Vulcans arrived on these shores with the secret of the craft of the ferrous ore, they could not foresee what an outpouring of words and paper it was going to cause on the banks of their dark river of Thames one day. No wonder it is only enthusiastic specialists whose mental digestion is strong enough to swallow the mixture undiluted day in, day out.

So far it has been two days during which

time we have advanced to the end of three clauses. And what a change in the House from the Billingsgate mood of the pre-Christmas era! Across the table, Minister and former Minister (Mr. Strauss) seem to execute a grave saraband, so excruciatingly anxious are they to be polite and considerate to each other. The guillotine, still merrily chopping away in the Transport Bill committee, here seems to be among the old, unhappy far-off things. The Government are obliged to the Opposition for their helpfulness which they will endeavour to reciprocate: naturally they appreciate the sensitivity of the Labour Party on the principle, but allowing for that it is not too much to hope that in a spirit of mutual helpfulness . . . and much more besides. Not to be outdone the Opposition leader, after piously doffing his bonnet to the eternal verity of public ownership, to which he and his honourable and right honourable friends could never be unfaithful this side of the grave, concedes that even a bad Bill may be improved if co-operation is present . . . and much more besides.

It is possible to sum up the effect of the Opposition amendments to date by saying that they tend always towards strengthening any element of public control present in the duties of the proposed new supervisory Board. A few are accepted by the Government, most are rejected.

A Government amendment inserted in the Bill marked the end—for the moment at least—of the foundries controversy. The Minister claimed that his compromise limited the powers of the supervisory authority to what was strictly necessary, consistent with the principle of the Bill. Conservative back-benchers tried hard to look as if they agreed with him.

PARLIAMENTARY NEWS

From Our Special Reporter

ANSWERING a number of questions by Mr. Nabarro in the House of Commons last week the Minister of Fuel and Power, Mr. Geoffrey Lloyd, said it was estimated that total capital expenditure by the National Coal Board in 1952 was approximately £45 million, by the Area Gas Boards £50 million, and by the British Electricity Authority and Area Boards £150 million. In 1952, 1,550 MW of plant was installed in raising the aggregate installed capacity of the B.E.A. to 17,165 MW. Varying circumstances at each station made it difficult to calculate an exact average but the cost per MW was of the order of £60,000. In 1946 1·43 lb of coal was consumed per kWh generated. The provisional figure for 1952 was 1·31 lb.

Mr. Lloyd said he was informed by the B.E.A. that the average load factor on its generating plant in 1952 was 48 per cent. He had no present intention of giving a general direction to improve the position. The Authority was no less anxious than he was to improve the load factor and he was at present discussing with it methods by which the use of electricity at off-peak hours might be further encouraged.

Electricity Pole Regulations

Commander Maitland asked the Minister of Fuel and Power if he would introduce legislation to enable him to revise and bring up to date the safety regulations which controlled the specifications for electricity poles.

Mr. Lloyd said he hoped to do this when the new draft regulations were ready.

Load Control Devices

Mr. Palmer asked the Minister of Fuel and Power if, in view of the recent completion by his Department and the Electricity Boards of a joint study of various load controlling devices and their uses, he would now make a statement.

Mr. Lloyd said he was at present discussing this matter with the Electricity Boards.

B.E.A. Organization

Mr. Palmer asked the Minister of Fuel and Power if he would make available the report of the special committee appointed by the B.E.A. and the Area Boards to investigate and make recommendations on the working of the organization since vesting day.

Mr. Lloyd said this was an internal committee of the B.E.A. which should decide the question of publication.

Air Pollution Prevention

Mr. Popplewell asked the Minister of Fuel and Power if he would give an assurance that the generating plant to be built at Stella, County Durham, would be fitted with the most up-to-date smoke and pollution prevention apparatus;

and when he hoped similar arrangements would be installed at Dunston power station.

Mr. Lloyd replied in the affirmative. The new station at Dunston had the apparatus but it had not been working properly and the engineers were trying to improve it. It might take some months to make it effective.

Brick Economy

Miss Ward asked the Minister of Fuel and Power what saving in bricks was expected to result from the different designs of the two power stations which he had authorized to be built at Carrington and Wakefield, respectively.

Mr. Lloyd said that Carrington used 10 million bricks and Wakefield should use between 2½ and 3 million—a saving of 75 per cent.

Peat Fuel

Replying to Major Anstruther-Gray, the Minister said that good progress was being made in the development of peat fuel. John Brown & Co. had made an experiment for the North of Scotland Hydro-Electric Board in which they ran a gas turbine for 1,000 hours on peat. The results of the test were being assessed. Ruston & Hornsby had constructed another type of gas turbine for his Department and this had made short test runs successfully and was soon to make longer tests. Also, at a peat-bog near Falkirk, they were installing an experimental machine to de-water peat ready for use.

Fuel Economy

Major Anstruther-Gray asked the Minister of Fuel and Power when he would be in a position to announce the result of his discussions following the recommendations of the Ridley Report on fuel economy.

Mr. Lloyd said he had already announced several decisions and he hoped to make a statement next Monday on the recommendations affecting industrial fuel economy.

Brookhirst Training Scheme

AN important principle of the training scheme of Brookhirst Switchgear, Ltd., is that apprentices entering at fifteen or sixteen are given the same initial training irrespective of the type of education they have received. It rests purely on ability and effort whether a boy is selected for all the training provided. This selection is made half-way through the apprenticeship period, that is, after two and a half years' training, and is dependent upon an apprentice having earned satisfactory works training reports, and in addition having reached the standard of "Ordinary National" in his technical education.

It was in January, 1948, that Brookhirst Switchgear introduced the present scheme. An important innovation was to arrange that every apprentice should have practical training in a wide variety of departments, moving from one department to another at three-monthly intervals. At the present time, out of a total of 137 apprentices (including fifteen probationers), 127 are attending technical classes, and of these three are taking their final examinations for Higher National, seven are taking the first stage of Higher National, and 17 are taking the final examinations of their Ordinary National. In the five years since the introduction of the present scheme ten boys have obtained their Higher National Certificate, thirty their Ordinary National and practically all these have been given positions in the technical or sales offices. Three major awards are made annually. The winner of this year's E. Noel Humphreys Award was Mr. P. E. Davies. This award took the form of a seven-day visit to Amsterdam as a guest of the company's Dutch agents, Groeneveld van der Poll & Co. The winner of the A. C. Livesey award for the best all-round apprentice of the year was Derek Watson. The Sportsmanship award was won by J. L. Owen.

Over forty other apprentices received smaller awards at the recent annual meeting of apprentices and their parents.

"CABMA" Register

THE compilation is approaching completion of the "CABMA Register" (Canadian Association of British Manufacturers and Agencies) which is an officially sponsored directory of British manufacturers and exporters whose products and services are available in the Canadian market.

A folder was circulated some time ago and it is announced that those firms who have not completed and returned the entry forms should do so not later than 28th February. Further copies of the folder are available from Kelly's Directories, Ltd., 186, Strand, London, W.C.2, who with Iliffe & Sons, Ltd., are the joint publishers.

It is stressed that free entries are included in the Register for all firms who stated that they were exporting to Canada when they completed the questionnaire prepared by the Dollar Exports Council and distributed by trade associations.

Engineering in Europe

Survey of Current Literature

THE reflection method, based on the production of pulses of travelling waves and their reflection at the point of a fault, is increasingly used for fault location in cables and, more recently, overhead lines. The actual detection of the fault is possible only if an unambiguous variation of the characteristic impedance at the fault point is clearly indicated by a cathode-ray oscillograph. However, even if the presence of such a defect is easily recorded, more elaborate means are needed for its exact location.

The instrument described works with two oscillographs, one of which gives a coarse overall representation of the conditions on the line whereas the second, called the "magnifier," is so connected that the trace appearing on its screen corresponds to a comparatively short section of the line only and is therefore magnified ten times.

Obviously it is so arranged that this section may be shifted over the whole length of the line and adjusted to a reflection indicated by the "overall" c.r.o. as the probable fault point. The handy instrument also comprises a curve-drawing arrangement which enables reflection curves of the whole line to be traced rapidly and with an accuracy permitting "normal" and "fault" reflections to be easily distinguished. The average measuring error is nearer to 0·1 than to 0·2 per cent.—"The 'Reflectograph,' a Fault-Locating Instrument for Cables and Overhead Lines, based on the Reflection Principle," H. Henneberg, *Siemens-Zeitschrift*, Vol. 26, No. 7, pp. 312–316, November, 1952, in German.

Plastic Insulation Materials

This is a necessarily brief account of the results of extensive tests made on thermosetting, thermoplastic and laminated insulation materials of which the surface and transverse resistivity, loss angle and dielectric constant were measured under widely varying temperature and moisture conditions, including total immersion in water. The influences of measuring electrodes, specimen treatment, and frequencies of the measuring currents (50–1,000 c/s) were also established. Further series of tests were concerned with arc and tracking resistance (the tracking being produced either by conducting deposits or by h.v. sparks).

The tests were conducted according to British and German (V.D.E.) test standards, as well as according to French standards (of the last, only those governing the granting of trade marks were available). The discussion of the results surveys the individual performances of the materials under each heading without considering the all-round performance of any single material.—"Research on the Various Electrical Tests on the Principal Plastic Insulation Materials," P. Dubois and R. Herou, *Révue Générale d'Electricité*, Vol. 61, No. 9, pp. 383–387, September, 1952, in French.

Cooling Indoor Transformers

This article deals with the natural and forced cooling of medium-size air-cooled transformers, the coolers of which are united to form a bank (excluding corrugated-tank type transformers). The required quantities of air and the corresponding temperature rise of the air at the outlet from the enclosing chamber are calculated from empirical formulæ both for natural and forced air cooling as a function of the loading.

It is found that a chamber designed for the cooling air quantity required for operation at the lower full-load rating with natural cooling is too small to absorb the far greater quantity of air needed for operating the transformer with forced draught at a higher full-load rating without the occurrence of dangerous over-temperatures. However, a change in the air ducting enables the problem of forced draught cooling to be solved satisfactorily without rebuilding or altering the size of the chamber.

The second part of the article investigates the relative merits of high and low pressure

systems of forced draught cooling with longitudinal and transverse draught. It is concluded that longitudinal h.p. cooling is useful only in combination with specially designed cells and auxiliaries, the low-pressure systems being more generally suitable for any existing cell, and particularly the transverse draught system. In general, widening of the ducts is all that will be required to make forced draught systems workable. Installation of fans in air inlet and outlet ducts can be regarded only as an emergency solution.—" Forced Air Cooling of Transformers erected in Chambers," E. A. Frowein, *Electro-Techniek*, Vol. 30, pp. 383–390, 9th October, 1952; pp. 428–434, 6th November, 1952, in Dutch.

Tapping Overhead Lines

A brief summary of the theory of capacitive power tapping from overhead lines, based on a T-type equivalent circuit, precedes the enumeration of the special conditions a transformer used for this purpose has to satisfy. Particularly convenient is the clear tabulation of all the important characteristics of the circuit for various ratios of transformer and antenna reactance. It shows that since the optimum output is obtained at resonance, transformer reactance and capacitive reactance should be as nearly as possible equal and, as the latter is constant and independent of load variations, the same should apply to the transformer reactance.

Since the voltage at the consumer's terminals should be kept constant, the transformer must have self-adjustment of the transformation ratio to handle overloads and over-voltages. Also its active resistance must be as low as possible, since the voltage variations at the consuming device in resonance conditions depend mainly on the ratio of transformer resistance to load resistance. It follows that a transformer of the usual type may be adapted to the special purpose only by an auxiliary inductance to be connected either in series with the primary winding or with the secondary winding, or with both windings.

Any of these three methods is beset with great technical difficulties and therefore the actual solution presented works with a removable magnetic shunt in the middle limb of a three-limb transformer. A later, improved model of the transformer places the shunt in one of the outer limbs. Results of experiments with various types of special transformers are given.—" Transformer for Capacitive Tapping of Power from H.V. Overhead Lines," V. Yu. Gessek, V. V. Ivashev, V. G. Kozhemyakin, L. D. Naumovskii, *Elektrichestvo*, No. 10, pp. 25–30, 1952, in Russian.

Strip Earthing

It is often overlooked when designing strip earths that owing to the very short peak period of lightning discharges conditions in earth wires, or strips, even shorter than 10 m cannot be regarded as steady and therefore cannot be represented by a quasi-steady equivalent circuit. The quasi-steady equivalent circuit may thus be used only on the condition $L_{earth}/R_{earth} \ll \pi^2/2$ μsec. The R_{earth} and L_{earth} depend on l_{earth} and on the soil resistivity ρ.

The author derives the " effective earth resistance " under simplifying assumptions (skin effect neglected, non-ferromagnetic earth wire, specific inductance and leakance constant) for the unsteady case from the telegraph equation (which is then formally identical with Fourier's equation of heat conduction). The results enable one of the three characteristics R_{earth}, L_{earth}, ρ to be found (and the whole problem to be solved) if the two others are given. In particular, R_{earth} and ρ can be measured very accurately.

Three cases of lightning discharges are assumed and the curves of effective resistance determined for each of them. Although the lightning current curves are only crude approximations to the actual, very complex phenomenon, conclusions of practical importance for the suitability of a given design of strip earth may be drawn from the solutions obtained.—" Some Considerations on the Problem of the Strip Earth under Impulse Stresses," E. Rollett, *E. und M.*, Vol. 69, No. 20, pp. 461–465, 15th October, 1952, in German.

[Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates. —Editors, *Electrical Review*.]

Trolley-buses to Replace Motor-buses

BRADFORD Corporation Transport Committee has recommended approval of a scheme, estimated to cost £28,500, for the conversion of the Wibsey motor-bus service to trolley-bus operation.

Circuit Breaker Research

I.E.E. Supply Section Paper

THE mechanism of arc extinction in circuit breakers is discussed in a paper prepared by Mr. A. F. B. Young (A. Reyrolle & Co., Ltd.), which was read at a Supply Section meeting of the Institution of Electrical Engineers in London last week.

The paper includes records of voltage, current and arc resistance near current zero for an air-blast circuit breaker to illustrate the process and to show how the current may be brought to zero prematurely. Sudden changes of arc resistance are shown to occur near current zero, when the r.m.s. current is low, as for unloaded transformers or shunt reactors, and the way in which these can give rise to current oscillations and sudden interruption of current (current chopping) is illustrated. Mr. Young shows that this process is affected by the circuit capacitance and by the characteristics of the circuit breaker.

The process of current chopping may give rise to high voltages across the shunt reactor or transformer and the way in which such voltages can be limited by restriking of the circuit breaker gap is illustrated for both air-blast and oil-break circuit breakers. Ways of estimating the limiting effect of these gaps from the electric strength of circuit breaker contact gaps are given.

Site and Test Conditions

A comparison of three-phase site conditions and test conditions is made and the limitations of the latter are pointed out. The relation between switching voltages and r.m.s. magnetizing current is studied, and it is concluded that the switching of unloaded transformers gives lower voltages than the switching of shunt reactors. The voltage produced by the switching of shunt reactors should, if required, be reduced by damping the reactor rather than by fitting resistors to all circuit breakers irrespective of their duty. A simple device is a low-voltage resistor connected across a tapping on the reactor during switching by an auxiliary switch that closes when the circuit breaker opens.

The use of switching resistors of the kind suitable for the control of rate of rise of restriking voltage can have little effect on the transient voltages due to current chopping by air-blast circuit breakers, but can produce significant reduction in voltages with the larger r.m.s. currents for oil circuit breakers.

DISCUSSION

Mr. D. P. Sayers (B.E.A.) opened the discussion by saying that the paper brought out the difficulty of reproducing service conditions at the test plant. The most conclusive indication of performance would be obtained by site testing, and the B.E.A. was prepared to collaborate with manufacturers by providing facilities for large-scale switchgear testing on the grid system, and a scheme might be developed of mutual benefit to manufacturer and user.

On the controversial issue of resistance switching it seemed that a high-speed 132 kV circuit breaker not incorporating resistance switching could, under certain conditions, produce overvoltages of 400 to 500 kV. Occasional 450 kV switching surges might be permissible on transformers having a 550 kV impulse level, but the older transformers had no definite impulse level and surges of this kind might represent a considerable risk.

The conventional circuit breaker did not clear the fault until the current had risen to from 10 to 30 times normal load current and the whole system had to be designed to stand up to the short-circuit stresses which might occur. What was wanted was an electronic circuit breaker which would first act as a brake to prevent the current rising to these great values and then interrupt it with little stress to the system.

Mr. T. W. Wilcox (Merz & McLellan) suggested that if internally-generated transient overvoltages could be abolished it would in certain cases almost halve the cost of a cable system. It had been

demonstrated that the transient overvoltage due to switching heavy currents could be eliminated by the use of resistors of comparatively low ohmic value shunted across the break, but this did not succeed in preventing the 50 c/s voltage to earth from rising to 1·5 times the normal phase value in certain circumstances or in eliminating transient overvoltages resulting from the interruption of small currents. These difficulties might be overcome if during any switching operation both sides of the breaker could be tied down to earth by means of resistors.

Mr. C. H. Flurscheim (Metropolitan-Vickers) said that no one had thought of a way to stop current chopping. The author suggested that the dielectric strength of the interruptors might be used to limit the voltage, but if the interruptor alone were relied on it would appear that the dielectric breakdown of the gaps must be undesirably reduced. To slow down the contacts also seemed undesirable. A third possibility was to put resistance damping on the breaker and this did not impair the voltage limit of the breaker; on the contrary, it could be used to improve its performance.

Three Approaches

Mr. J. M. Ferguson (English Electric Co.) suggested that three attitudes might be adopted towards overvoltages produced by current chopping of inductive currents. One was to consider only the magnetizing currents of transformers and to say that dangerous currents were not produced. The author's results showed that there was no substance in this contention. Another was to say that overvoltages would occur at rare intervals and that the protection of the system must take care of them, and this was open to objection. The third was to let the breaker protect itself and fit a resistor across the contacts.

Dr. J. R. Mortlock (B.T.H.) complimented the author on the physical interpretation of a very complex phenomenon and subjected the paper, by means of lantern slides, to considerable criticism on points of detail.

Mr. H. F. Maas (Ferguson, Pailin) congratulated the author on bringing out so clearly the interaction between the circuit breaker and the circuit and hoped this would lead to the disappearance of the notion that the circuit breaker alone was responsible for the overvoltages on current chopping. He also described by means of slides some recent work carried out by his company on circuit breaker design.

Dr. R. Willheim (consulting engineer) contributed a few notes on the history of the problem.

Mr. E. L. White (E.R.A.) said that there were features of the multiple current-chopping phenomenon which were not brought out in the paper but which might have an important influence on the voltages set up in windings. At the first restrike a steep-fronted impulse was applied to the winding which would set up an internal complex oscillation. One effect was that the incidence of current chopping might be influenced by the fact that the magnetizing current now had superposed on it a h.f. transient oscillation, while the restriking voltage might also have a transient oscillation superposed on it. It was thus possible for synchronization to occur between the current-chopping phenomenon and the natural oscillation of the circuit.

Switching Surges

Mr. A. Roxburgh (B.T.H.) remarked that the paper came at an opportune moment, because designers were engaged in producing circuit breakers for 200 kV and even 400 kV systems, and there was general agreement that where these systems were effectively earthed the apparatus to be used on the system could be designed with a lower margin between the insulation level and the normal operating level than was usual with apparatus up to 132 kV. Increasing attention would therefore be focused on switching surges to ensure that dangerous overvoltages were not produced.

Dr. W. B. Whitney (E.R.A.) mentioned that the E.R.A. was about to publish the results of some measurements on 132 kV transformers *in situ*. Of nine measured, seven had an equivalent lumped capacitance per phase of the order of 0·001 μF.

Mr. L. Csuros (B.E.A.) put forward considerations to indicate that test plant conditions might reduce the tendency of the breaker to chop and also the maximum value of overvoltage appearing on the transformer.

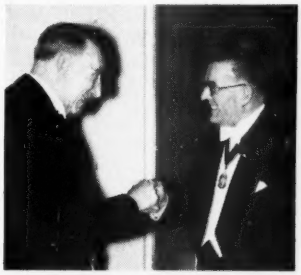
The author, in a brief reply, said it would take a long time to collect enough data from site testing. There was need for an agreed test circuit, even if an artificial one, which would at least give comparative results.

Contractors' Annual Dinner

Appeals for Tax Relief

JUST over 600 members and guests attended the annual dinner of the Electrical Contractors' and Allied Associations at Grosvenor House, London, W.1, on 28th January. Mr. W. T. Trace, the President, occupied the chair and the principal guest was Lord Balfour of Inchrye, P.C., M.C.

Proposing the first toast, "The Allied Associations and Honorary Officials," Lord Balfour mentioned that the E.C.A. membership was responsible for between 80 and 90 per cent of the "private enterprise" installation work in the British Isles and employed about 100,000 people. The speaker said that while the nationalization of coal, gas and electricity had to be accepted, installation work was a different matter. It was pleasing to see the B.E.A. lion lying down with the E.C.A. lamb, but the lion must not abuse his strength.



The President (right) receives Mr. C. R. Bates

Lord Balfour went on to deal with the country's economic position. He urged all concerned to concentrate on the battle for the markets of the world on which national survival depended. We had the technical knowledge and skill but our plant and machinery needed bringing up to date. In this direction taxation was a great handicap and depreciation allowances were totally inadequate. He suggested that employers and workers should get together to present agreed proposals to the Government. One proposal might be a "tax holiday" scheme designed to enable industry to put by sufficient funds for the replacement of plant. Organized labour should approve this as a means of safeguarding their livelihood. Another thing was that the Government must re-kindle the desire to save by exercising the utmost economy in expenditure.

In the course of his response, Mr. Trace referred to the improvement in the country's economic situation during the past year. He went on to say, however, that the success of our export trade depended in the end on a stable home market. Rearmament was recognized as being essential, but the Government must restrict its expenditure wherever possible to give substantial relief from taxation.

Mr. Trace instanced purchase tax, which was now used to bolster revenue and restrict the purchase of electrical appliances at a time when the falling-off in the demand for electricity was causing serious concern. He realized that the Government could not relieve one section alone, but it should relieve all industry from the crushing burden of taxation which was having such serious effects. Mr. Trace also called for fair play for retailers when purchase tax was removed or reduced so that they could

Left to right: Col. C. Banks, M.P., Mr. P. G. Wallis, Mr. H. Drake, Mr. S. N. Watkins, Lord Balfour of Inchrye, Mr. G. T. Dickson, Mr. A. S. Lowe, Mr. R. Nicholls and Mr. W. E. Babb

recover tax paid on articles remaining unsold. While they recognized the need for making the best uses of the country's fuel resources they deplored the propaganda which sought to prejudice the public against electricity and asked that the public's freedom of choice should be untrammelled. They and the B.E.A. were concerned at the falling-off of the cooker load; this was a problem which should be dealt with nationally and they hoped soon to have joint discussions on the subject.

Testimony must be paid to the Government for relaxing many controls, but it was felt that even now some controls were being maintained for a longer period than necessary. He appealed for greater boldness in this respect. Mr. Trace referred particularly to the welcome raising of the licence-free limit for building operations, but said that there were accumulations of material and labour which could not be used for any other purpose. He urged that all controls in this field should be removed.

Mr. S. L. M. Barlow (vice-president) proposed the health of the guests, referring in the first place to Lord Balfour's R.A.F. and Governmental career and then expressed his regret at Lord Citrine's inability to be present. He voiced the admiration of the Association for Lord Citrine, but said that they would willingly relieve him of the contracting activities which he had inherited. Mr. Barlow then mentioned the presence of Col. C. Banks, M.P., and Mr. Howard Robertson, President R.I.B.A., and detailed several representatives of many branches of the electrical industry.

Mr. Howard Robertson, replying for the guests, said that architects had great confidence in E.C.A. members whose qualifications and apprentice training schemes were a guarantee of good work. Col. Banks also responded, partly in some verses humorously touching upon the relationships between the B.E.A. and the E.C.A.

The President's health was proposed by Mr. A. V. Milton, who said that he and Mr. Trace had worked together in Association affairs for twenty years. Mr. Trace responded and afterwards members and guests got together in a reunion.

Dame Caroline Haslett with Messrs. C. R. King and E. A. Mills

Col. C. W. G. Walker and Mr. E. A. Reynolds

Left to right: Mr. L. Howles, Mr. J. Eccles, Mr. T. E. Alger, Mr. S. L. M. Barlow, Mr. J. R. Halliwell, Mr. L. C. Penwill (director) and Mr. M. R. H. Sadler

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily or publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Modern Babel

I HAVE worked in several parts of the world and I am now in the British West Indies. In most places one needs to acquire at least a smattering of the local language but when this is complicated by the necessity to also learn a foreign system of weights and measures and relate it to one's own, then confusion becomes worse confounded.

The British West Indies are subject to strong United States influence owing to proximity and, even more, to the establishment of wartime bases. Here, in Antigua, I have inherited an electricity supply system installed by the Americans plus another one installed very much earlier by the British. Wire gauges enter almost hourly into my affairs and the confusion between Brown & Sharpe gauges and s.w.g. is a constant nightmare. It is useless to ask anyone what gauge a particular wire is as they do not know whether it is B. & S. or s.w.g. Pole climbing with a wire gauge is not a pastime I enjoy at my age.

For example, No. 6 B. & S. has a diameter of 0·162in and No. 6 s.w.g. is 0·192in. Only No. 0 has some sort of agreement. Then one has to struggle with U.S. gallons and British gallons, with short tons, with degrees F and C, with kilos and lb, litres and gallons and so on. Mistakes can, and do, occur. The waste of time is colossal. I will not refer to the multiplicity of screw threads, plugs and sockets and other entanglements.

Surely it is not beyond the wit of man to devise some sort of standardization. Personally, I do not care a hoot whether we all use B. & S. or s.w.g. so long as we all use the same, at least so far as the English-speaking peoples are concerned. We are bedevilled enough with strange languages and currencies (in B.W.I. the latter are a curse) but common standards such as I have mentioned should be within easy reach.

It seems to me that the moment any particular nation achieves "independence" it must invent not only a new language, but an entirely new system of weights, measures, currencies and other standards so as to make trade and intercourse with other nations as difficult as possible. We hear much about the "Iron Curtain," but what about paper curtains, currency, language, standards, passports, visas, import and export licences, quotas and a host of other curtains. As an example, travel between so-called British possessions is as difficult to-day as was pre-war travel to a foreign country. But I suppose it all means jobs for some minister with a host of petty officials to carry out his will.

R. H. BENT,
Engineer and Manager,
Antigua Electricity Board.
St. John's, Antigua, B.W.I.

Engineers and the Commonwealth

DO British engineers at home appreciate their responsibility as well as their opportunities in the field of Commonwealth relations and developments?

Our manufacturers know that competition is increasing in the overseas markets, that times are changing and that engineers in Commonwealth countries are not content merely to follow the lead of the Home Country. A more active policy is needed: first to study the needs and problems of those countries so as to supply them with what they want and at the right time, and secondly to keep their engineers in touch with the latest achievements and problems at home and the technique which has maintained the reputation of British engineering so well in the past. Particularly is this so in Canada, where the proximity of the United States and the pressure of American investment exert such a dominating influence.

I am sure that this situation merits the earnest attention of all engineers and vigorous and concerted action through such organizations as the Institution of Electrical Engineers, the British Electricity

Authority and the Association of Consulting Engineers, as well as the British Electrical and Allied Manufacturers' Association and the Cable Manufacturers' Association.

May I commend this to the Technical Press as a worthy crusade? The Coronation period offers a unique opportunity for stirring up interest in the great developments in progress or projected throughout the Commonwealth in which the Home Country can and should make her contribution.

*London, S.E.*1. D. P. SAYERS.

Trotter-Paterson Lecture

Nervous Reaction of Retina

LAST week Prof. E. D. Adrian, President of the Royal Society, delivered the second Trotter-Paterson Memorial Lecture at a meeting of the Illuminating Engineering Society at the Royal Institution, Albemarle Street, London, W.1. Prof. Adrian spoke on the nervous reaction of the retina and pointed out that vision was the most dominant sense. He went on to explain that what we saw was not a faithful reproduction of what appeared on the retina; it was an idealized version, a certain amount of "editing" and underlining having been done by the nervous system. After describing the complex structure of the retina and the interconnection of the "rods" and "cones" he discussed the way in which electrical impulses in nerve fibres were studied and how much had been learnt thereby. In conclusion Prof. Adrian referred to artificial lighting and the behaviour of the retina.

The speaker was introduced by Dr. Wellwood Ferguson and a vote of thanks was subsequently proposed by Mr. H. C. Weston and seconded by Mr. Wright in the absence, through illness, of Dr. Sykes.

Boiler Tubes

Factors Affecting Thickness

THE thickness of tubes for water tube boilers was the subject of a paper read last week by Mr. D. W. Crancher (British Shipbuilding Research Association) before the North East Coast Institution of Engineers and Shipbuilders.

The paper first drew attention to the wide discrepancy between thicknesses demanded by various classification societies, whose rules were described as empirical and made no allowances for thermal stresses. The rules of the principal societies were briefly reviewed together with previously published work on this subject.

The object of the author was to examine those factors which affected the thickness of boiler tubes; both tube stresses and heat transfer were considered, including non-uniform heating such as occurred in tubes subject to furnace radiation. A new approach to the subject, described as rational, defined the optimum thickness as that which would permit the maximum heat absorption rate, for a given working pressure, without exceeding the safe working stress. This idea was developed at some length in the paper, one of the most important conclusions being that the optimum thickness occurred when the pressure and thermal stresses were equal: that meant when the total stress was twice the pressure stress. A design formula based on this conception was suggested which indicated that the B.S. 1113 (1951) rule was satisfactory for tubes of from 4in to 2in diameter but would result in rather thick 1¼in tubes. Lloyd's rules (1952) resulted in tube thicknesses considerably in excess, at all diameters, of those suggested by the author whereas the American rules agreed well with his criterion.

New Protective Relay

Characteristics and Applications

AT a joint meeting of the Measurements and Supply Sections of the Institution of Electrical Engineers held in London on Tuesday last, a paper dealing with a new permanent-magnet moving-coil relay which overcomes the non-linearities associated with electromagnetic differential relays was presented by Messrs. C. Ryder, J. Rushton and F. M. Pearce (all of the Metropolitan-Vickers Electrical Co., Ltd.). After describing the construction and design features of the relay the authors discussed its application to balanced current protective systems and considered the factors affecting the use and interpretation of through-current bias. Other applications of the relay to impedance, pilot-wire and busbar protective systems were also described together with a new scheme of instantaneous differential protection for power transformers.

The linear characteristics of this relay lead to better prediction of overall behaviour and advance the technique of calculable performance. Owing to the small burden imposed on current transformers a reduction in overall dimensions is possible without sacrifice in overall technical performance.

This relay has made possible an increase in stability ratio at the same time retaining adequate thermal capacity wherever it has been applied. The behaviour of the relay in the schemes discussed indicates that a wide field exists for further application.

RECORD CANADIAN DEVELOPMENT

1,064,600 h.p. of New Hydro-Electric Plant Completed

LAST year the total capacity of new hydro-electric generating units completed in Canada (1,064,600 h.p.) was higher than in any previous year. Allowing for dismantling of old plants and list adjustments, however, the net increase (961,726 h.p.) is slightly below the previous record of 988,675 h.p. set up in 1943 when the huge Shipshaw plant of the Aluminum Company of Canada was completed on the Saguenay River. In 1952, new capacity was more evenly distributed across the country, although the greater portion was in the Province of Quebec (597,000 h.p.). According to the annual survey conducted by the Water Resources Division, Department of Resources and Development, the aggregate installed capacity of water-power plants in Canada is now 14,304,230 h.p., which represents 22 per cent of known resources. New plants and extensions which are scheduled for operation in 1953 total 860,000 h.p., while other developments which are under preliminary construction, or are definitely planned for later years, exceed 2,000,000 h.p.

Although the production of electrical energy to meet Canada's expanding industrial and domestic consumption continues to be largely from hydraulic sources, thermal capacity is also increasing. Supplemented by the output of new hydraulic and steam plants, total production of electrical power was at a rate of approximately 8 per cent above 1951. In the country as a whole, power production facilities were sufficient to meet the present demand, but little reserve capacity was available.

In power distribution, construction was also very active. Good progress in rural electrification was achieved, particularly in Ontario, Quebec and Manitoba.

Details of the chief power projects are

PRINCIPAL CANADIAN POWER SCHEMES

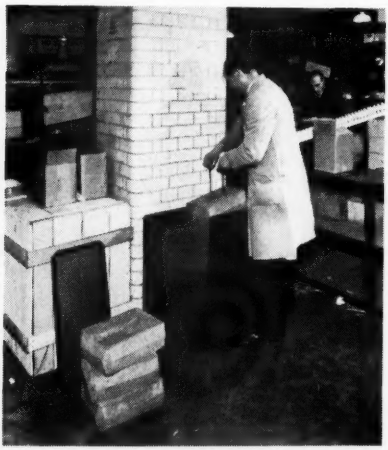
Scheme	Capacity in 1,000 h.p. (Hydraulic) or MW (Steam)	
	Present Programme and Completion Date	Planned
QUEBEC		
Quebec H.E. Commission:		
Beauharnois No. 2, St. Lawrence River	4× 55–6 (1952) 2× 55 (1953)	1,408 (whole devpt)
Bersimis River	300 (1956)	1,000
Aluminum Co. of Canada:		
Chute du Diable, Peribonka River	5× 55 (1952)	275
Manicouagan Power Co.:		
Manicouagan River	2× 45 (1952–3)	270
ONTARIO		
Ontario H.E.P. Commission:		
Otto Holden, Ottawa River	8× 33 (1952–3)	264
Sir Adam Beck-Niagara No. 2	12×105 (1954–6)	1,260
Richard L. Hearn, Toronto (steam)	4×100 (1951–3)	400
J. Clark Keith, Windsor (steam)	4× 66 (1951–3)	264
BRITISH COLUMBIA		
B.C. Electric Co., Ltd.:		
Wahleach Lake	1× 82	82
Bridge River	4th 62 (1954)	248
B.C. Power Commission:		
John Hart, Campbell River	2× 28 (1953) (present capacity 112)	168
Aluminum Co. of Canada:		
Nechako-Kitimat	Initial operation 1954	420 (ult. 2,000)
Cons. Mining & Smelting Co.:		
Waneta, Pend d'Oreille River	2×105	420
MANITOBA		
Manitoba H.E. Board:		
Pine Falls, Winnipeg River	6× 19 (1951–2)	114
McArthur Falls, Winnipeg River	8× 10 (1955)	80
Brandon (steam)	2× 30 (1956)	120
Winnipeg Elec. Co.:		
Seven Sisters Winnipeg River	6th unit, 37 (1952)	225
City of Winnipeg: Steam station	15 (1952) 25 (1953)	
ALBERTA		
City of Edmonton: Steam station	1× 30 (1953) (present capacity 62)	92
City of Medicine Hat: Steam station	1× 30 (1953) (present capacity 13·5)	43·5
SASKATCHEWAN		
Saskatchewan Power Cpn.:		
Saskatoon & Estevan (steam)	70 (1954–57)	204 (all projects)

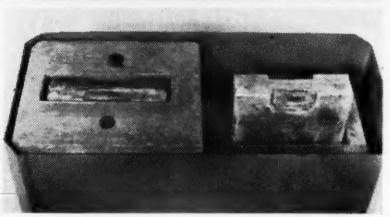
given in the accompanying table. Among the country's largest developments is that on the St. Lawrence River at Beauharnois, where 222,000 h.p. was added last year. On the north shore of the lower St. Lawrence the Bersimis scheme will eventually yield some 1,000,000 h.p. In the field of transmission an interesting proposal is the Quebec Commission's plan to lay a 31½-mile submarine cable in the St. Lawrence from the Manicouagan Peninsula to Les Boules. A 146-mile line is contemplated to serve the Lake Chibougamau mining district from the Ottawa River plants. In British Columbia the Wahleach development is notable for its high head (2,000ft). The Aluminum Co. of Canada's great Nechako-Kitimat scheme was well under way at the end of the year, the excavation of the underground chamber to house the first three units being then half completed. The Ontario Commission extended its rural lines by 1,950 miles and other lines by 596 miles.

Storage Space-Heater

Useful Off-Peak Load

FOR some years past it has been the practice on the Continent to use, for reasons of economy, a small fire to heat a mass of brickwork which is allowed to give out its stored heat to the surrounding air and thus provide background heating over a long period. By the use of concrete and a small, specially designed electric element mounted in a simple sheet steel case of attractive appearance, the General Electric Co., Ltd., has obtained the same effect. These electric thermal storage radiators are designed for use on a time-switch-controlled circuit so arranged that the radiators draw their power during the night off-peak period, and convert this energy into heat for the following day's space heating.





G.E.C. storage space heater being assembled with (*below left*) method of mounting concrete blocks on concrete embedded elements

These thermal storage heaters have a maximum charging period of eight hours. Their heat output expressed as a percentage over 24 hours is 35 per cent during the eight hour charging period, 56 per cent during the day, and the remaining 9 per cent in the last eight hours. The heat emitted during the charging period provides a comfortable room temperature at the start of the day.

Necessarily the heater is heavy (480 lb). To overcome the difficulty of carrying and installing this heavy mass, the heater is constructed so that it can be dismantled for transport. The heat storage medium of concrete is divided into ten blocks each weighing 40 lb which can be placed in the heater after it has been put into position and connected. Despatch is simplified by packing the heater in three sections (*a*) the metal body, (*b*) the elements, (*c*) ten concrete blocks. Full instructions for assembly are enclosed with the heater together with lifting keys for handling the blocks. The height of the heater is 29in, width 25in, and depth 11in. The finish is bronze and the loading 1·5 kW. The list price is £16 to which must be added in this country purchase tax amounting to £13 5s 2d.

Commerce and Industry

Research Development

Fuel Price Trends

THE report and accounts of the National Research Development Corporation for 1951–52 have been published (H.M. Stationery Office, 9d). Sir Percy H. Mills (W. & T. Avery, Ltd.) is the chairman of the Corporation whose functions are to secure the development or exploitation of inventions resulting from public research (or other inventions of public interest) and to acquire and deal with rights in such inventions.

Broad particulars are given of the inventions dealt with during the year and special reference is made to electronic digital computers. These were the subject of 99 inventions assigned to the Corporation (59 by universities, 30 by Government Departments and corporations and 10 by industrial firms). In respect of 74 of these inventions 479 patents have been applied for in ten countries.

The Corporation has placed a contract for four machines essentially similar to that installed at Manchester University in accordance with the design of Professor Williams, F.R.S. It is also entering into a further contract for a prototype of a machine of very much reduced size based upon the development of special techniques. It is hoped that the use of these techniques will contribute towards a decrease in cost and an increase in reliability. Grants are being made in support of work at Manchester University.

Radio Show

The provisional dates previously announced for the National Radio Show, Earls Court, London, are now confirmed. The Show will be open to the public from 2nd to 12th September. There will be a preview on 1st September. In addition to the usual representative exhibits of radio and television receivers, components and valves, there will be an increased number of electronic demonstrations, an enlarged training exhibit and demonstrations by the Services.

A Sturdy Cable

In the course of some excavating operations being carried out recently by a local contractor for the Lee Valley Conservators, an Enfield 66 kV pipe-line compression cable was accidentally damaged and bent by a bulldozer. This compression cable was laid between Hackney and Walthamstow in 1932 and, despite the rough treatment it received, its steel pipe was not fractured and the cable remained "alive," carrying its full load. Only the wrapping was stripped off the pipe at the point of collision, and this was quickly repaired.

An Enfield 66 kV cable which continued to function after being damaged by a bulldozer. *Inset:* **Part of the damaged cable**

Fuel Prices

In the January *Ministry of Labour Gazette* details are given of the course of prices during the past year. As regards fuel, the general increase was in the neighbourhood of 9 per cent. Coal prices were increased by about 6½ per cent in January; the operation of summer prices reduced the average price but there was a steady rise thereafter to a point slightly higher than in January. Coke prices rose by 10 per cent during 1952 and gas prices by about 8 per cent, mainly in the first half of the year.

The average level of electricity charges rose in every month of the year as prices in various

areas were increased and at the end of the year charges were, on average, between 8 and 9 per cent higher than at the beginning of the period.

Batti-Wallahs' Society

The Metropolitan magistrate has much to contend with in the course of his duties, but although he has to exercise considerable patience, his work has its lighter side. At last week's luncheon of the Batti-Wallahs' Society, Mr. F. J. Powell, magistrate at Clerkenwell, regaled his listeners with an account of some of his experiences. In more serious vein, however, he compared the dispensation of justice in the time of Dickens with that of the present day, and while he condemned the harsh measures of a century ago, we gathered that he considers that the pendulum has now swung a little too much the other way.

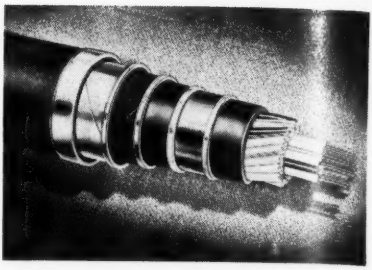
Mr. T. C. F. Bigland (the " Mate "), reminded members of the ladies' night to be held on 18th March, and asked that early reservations should be made.

Plastic Telephone Cables in Denmark

The first " Telcothene " (polythene) insulated carrier frequency multiquad land communication cables in the world, which were laid in 1952 between Copenhagen and Roskilde, Denmark, and manufactured in Britain by the Telegraph Construction & Maintenance Co., Ltd., of Greenwich, were formally handed over to Mr. G. Irming, managing director of the Kjobenhavns Telefon Aktieselskab, by Mr. J. N. Dean, managing director of Telcon, at a dinner in Copenhagen on 28th January.

The two cables, each about 20 miles (32 km) long, were laid last year along the important communications route between the ancient and modern capitals of Denmark as an experiment and form part of the first stage of an extensive new telephone network now being installed in the Island of Sjealland by the Copenhagen Telephone Company.

In contrast to normal paper-insulated telephone cable, in these plastic types the copper



Sample of 12 quad 1.02 mm " Telcothene " insulated high frequency telephone cable made for Denmark

conductors are completely insulated with a solid dielectric, "Telcothene," which is unaffected by water, and the insulated conductors therefore do not require lead covering, merely a tubular " Telcothene " sheath. They are remarkably light in weight, which makes installation correspondingly easy. Fault liability is low, but if the sheath is accidentally penetrated without damaging the insulated conductors, circuit continuity is maintained. The two Telcon cables, each containing 48 conductor wires, have a capacity of over 1,000 circuits. They cost £50,000.

" Standard News " Silver Jubilee

The first issue of the year of " Standard News " (Standard Telephones & Cables, Ltd.) marks the completion of twenty-five years and the cover is appropriately in silver relief. In addition to the usual interesting illustrated articles and notes on Standard people and events there is an inset in the style of 1928 containing items from the first volume.

Indian Electrical Manufacturers

The Indian Electrical Manufacturers' Association held its annual general meeting and conference recently, the opening ceremony being performed by the Minister of Commerce and Industry (Shri T. T. Krishnamachari). Mr. C. M. Shaw, sales manager and director of the General Electric Co. of India, Ltd., was called upon at short notice to propose a vote of thanks to the many distinguished guests present. In the accompanying photograph he is shown

Mr. C. M. Shaw speaking at the annual meeting of the Indian Electrical Manufacturers' Association

addressing the gathering. Seated (left to right) are the Minister, the chairman of the Association (Mr. V. S. Sitapati) and the secretary (Mr. R. D. Vidyarthi).

Electrical Pocket Book

This year's 360-page edition of the *Mechanical World* Electrical Year Book is now available from Emmott & Co., Ltd., 21, Bedford Street, London, W.C.2, price 3s. As usual it is a revision of the previous year's edition and this time contains an entirely new section on electric lifts dealing with all the equipment involved up to a completely protected push-button operated lift. The notes on the I.E.E. Wiring Regulations have also been revised and in addition to general revision further information has been added to the section on control gear.

Midlands Ideal Home Exhibition

The Birmingham Post & Mail, Ltd., has acquired the Midlands Ideal Home Exhibition which will take place this year from 23rd September to 17th October at Bingley Hall, Birmingham.

Electricity at the Building Centre

The British Electrical Development Association, which is responsible for the Electrical Section at the Building Centre, 26, Store Street, London, W.C.1, has produced a handsome illustrated booklet describing the exhibits in the Section. The booklet shows very well (to quote from it) that " the Section has been designed to give a summary of the best principles in the installation and utilization of electricity."

New Norwich Showrooms

New demonstration showrooms have recently been opened at 31, St. Peter's Street, Norwich, in the premises of Johnson, Burton & Theobald. Here a large selection of " Atlas " commercial, industrial and domestic fluorescent lighting fittings, made by Thorn Electrical Industries, Ltd., are on view together with a full range of "double-life" fluorescent tubes and tungsten filament lamps. Most of the range will be held in stock for delivery in the area which the company serves as wholesale electrical factors, including the counties of Norfolk, Suffolk, Essex, Cambridgeshire, East Lincolnshire, Huntingdonshire and parts of Holland (Lincs).

"Atlas" lighting fittings display at the Norwich showrooms of Johnson, Burton & Theobald

Scottish Building Centre

At the annual general meeting of the Scottish Building Centre, held in Glasgow on 29th January, Col. G. Gardner-McLean, who was in the chair, stated that during 1952 the many activities carried on in the Centre had been successfully maintained and developed. In acting as a link between the manufacturer with a specialized product and the potential user, the Centre had continued to offer a valuable service both to technical and trade people and to the general public. The extent of both public interest in the Centre, and the Centre's usefulness to everyone interested in building materials and appliances could be judged by the fact that more than 18,000 people visited the Centre during the year. The number of inquiries dealt with by the technical staff exceeded 9,000.

New Hoover Laboratories

New laboratories recently opened at the Merthyr Tydfil factory of Hoover (Washing Machines), Ltd., as part of an extensive building and development programme have been equipped with the most modern apparatus for metallurgical and chemical research and process investigation. The chemical section is used to check the properties of materials such as plastic moulding powders, electro-plating constituents, resins, paints, fluids used in metal treatments and other materials. The various chemical processes used in manufacture are also checked and a quality control maintained.

The equipment of the metallurgical laboratory enables the most stringent tests to be carried out on metallic raw materials and also into their reaction under conditions of manufacture and subsequent use in the product. Another

important use is to test the properties of materials which may become available as alternatives to those difficult to obtain.

Alloys are tested for tensile strength, elongation, yield point, and other properties by a Denison tensile testing machine, a Hounsfield tensometer performing the same service for very small pieces of metal. Two thermostatically controlled Gallenkamp electric ovens are used for heat treatment at predetermined temperatures up to 1,000 deg C, one of them being used for the determination of carbon in steels. A Cook, Troughton and Simms universal photographic microscope is used for the microscopic and photographic investigation of metals, up to a magnification of 1,500 diameters. A Hilger Spekker photo-electric absorptiometer provides for the analyses of metals by photo-electric means, while other equipment includes a Vickers " Pyramid " hardness testing machine.

Trade with Holland

We are informed by the Vereniging Bureau voor Handelsinlichtingen (Commercial Intelligence Office), Oudebrugsteeg 16, Amsterdam, C., Netherlands, that the " Buvoha Trade Letter," which it circulates annually to all parts of the world, contains the names and addresses of Dutch firms seeking trade connections abroad. Copies can be supplied gratis.

Lamp Research

Dr. J. N. Aldington, managing director of Siemens Electric Lamps & Supplies, Ltd., gave a lecture-demonstration on " Research and the Lamp," at the Philharmonic Hall, Liverpool, on 29th January. The event was held under the auspices of the Merseyside Electric Lighting Services Committee, a coalition of local associations, and was attended by about 1,800 people, including members of the electrical industry and 500 sixth form schoolboys. The Lord Mayor of Liverpool presided. Dr. Aldington said that research in the electric lamp industry was directed towards improving the quality of existing light sources, to investigate new materials or phenomena which might have an influence on the development of new sources and thirdly towards lamp and lighting applications. Reviewing the methods of making light, he dealt with incandescence, the discharge of electricity through a gas or vapour, and fluorescent lamps. In the course of his address Dr. Aldington gave a number of demonstrations.

Cookers for Malaya

In our issue of 9th January we reported that specially designed electric cookers were being marketed by the General Electric Co., Ltd., in Malaya, and that the Singapore City Council had ordered 500. These new " Eastern " types have a modified hob structure to accommodate the *kwali*, the traditional round-bottomed Malay utensil for cooking rice, shown in the accompanying illustration. Simmer-switch control is fitted.

A *kwali* held above the specially designed radiant hot-plates

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £166 0s 0d
COPPER, H.C. Electro	ton £285 0s 0d
Fire Refined 99·70 per cent ..	ton £282 10s 0d
Fire Refined 99·50 per cent ..	ton £274 0s 0d
COPPER Tubes	lb 2s 8½d
Sheet	ton £340 0s 0d
H.C. wire and strip	ton £336 0s 0d
LEAD, English	ton £95 15s 0d
Foreign	ton £94 0s 0d
MERCURY	flask £70 10s 0d
TIN	ton £968 0s 0d
ZINC, G.O.B. Foreign	ton £84 5s 0d
Electrolytic	ton £88 0s 0d
BRASS Tubes	lb 2s 2¾d
Sheet	ton £271 0s 0d
Wire	lb 2s 8¼d
PHOSPHOR BRONZE	
Wire	lb 4s 1¼d
RUBBER, No. 1 R.S.S. spot ..	lb 23¼d-23¾d

Rhodes Centenary Exhibition

An Exhibition of British Industrial Design has been organized by the British Council for the Commonwealth Relations Office as part of the United Kingdom Pavilion in the forthcoming Rhodes Centenary Celebration at Bulawayo, Southern Rhodesia, which will be visited by Queen Elizabeth the Queen Mother and Princess Margaret.

The object of this section of the United Kingdom Pavilion is to show the unbroken tradition of British industrial design in those fields most likely to be of interest to the people of Southern Rhodesia. Some of the exhibits, which include examples of kitchen and domestic equipment, radio sets and lighting fitting , were on show at the Imperial Institute, Lond , last week, but a certain number which ar being

specially made for the exhibition have not yet been delivered.

The display included the following electrical equipment and apparatus:—"Baby Belling" cooker (Belling & Co., Ltd.); Parnall E.C.12 cooker (Parnall (Yate), Ltd.); electric clock (General Signal & Time Systems, Ltd.); radio sets (Murphy Radio, Ltd., and Pye, Ltd.); electric kettles (John Dale, Ltd., Premier Electric Heaters, Ltd., and E.M.I. Sales & Service, Ltd.); electric irons (Morphy-Richards, Ltd., E.M.I. Sales & Service, Ltd., Thorn Electrical Industries, Ltd., and the General Electric Co., Ltd.); glass plate warmer (English Electric Co., Ltd.); and floor polisher and vacuum cleaner (Fillery's (Gt. Britain), Ltd.).

New Instrument Company

The British Thermostat Co., Ltd., Sunbury-on-Thames, has announced the formation of a new company known as Teddington Industrial Equipment, Ltd. This new company will be exclusively concerned with instruments designed for use in heating, ventilating, air conditioning, process control applications and all instruments for the industrial field as well as the British Thermostat Co.'s recently developed range of i.c. engine control panels and shut-down units. The directors of the new company include Mr. J. E. Sherlock, managing director, and Mr. E. Burman, formerly general sales manager of the parent company.

Brynmawr Rubber

Brynmawr Rubber, Ltd., is reorganizing its subsidiary selling company, Brynmawr Rubber (Sales), Ltd., by mutual agreement between the boards of the two companies. Until further notice, all correspondence and inquiries concerning Brynmawr products should be addressed to Brynmawr Rubber (Sales), Ltd., at Brynmawr, Breconshire. This company has a mutually acceptable understanding with Major H. L. Anderson and Mr. T. T. Ottowell, the retiring directors of Brynmawr Rubber (Sales), Ltd., who are resuscitating their business and retaining their office at 70, Finsbury Pavement, E.C.2, from which address they will be operating under the name Hemisphere Rubber Co., Ltd.

Trade Announcements

The **Aberdare Electric Co., Ltd.**, has opened an office at 36, Victoria Street, London, S.W.1 (telephone: Abbey 1060), under the management of Mr. E. C. Green. This office is solely for the sale of "Thermodare" space heaters.

Hurseal, Ltd., 229, Regent Street, London, W.1, announces that in future it will deal directly with wholesalers and retailers in the north of England. Branch offices and stores have been opened at 317, Chester Road, Sutton Coldfield, Birmingham, and at 23, Strutt Street, Manchester, 2.

Thorn Electrical Industries, Ltd., announce that the "Mary Ann Doubleway" automatic electric iron is again in production and is being distributed through their subsidiary company, Smart & Brown (Engineers), Ltd.

A northern office of **Hadley Sound Equipments, Ltd.**, of Smethwick, Staffs, was opened at Deansgate House, 274, Deansgate, Manchester, on 2nd February. The manager is Mr. A. E. Stocker, who has been the company's northern representative for some time.

The **Aluminium Wire & Cable Co., Ltd.**, has opened a branch office at Transreef House, 66, Marshall Street, Johannesburg, South Africa. This office will cover the company's activities in the Union of South Africa, the Rhodesias and Nyasaland. Mr. E. Hall is in charge.

Thos. W. Ward, Ltd., Sheffield, have been appointed official general distributors of "Wetherill-Hydraulic" loading shovels and "Staffa" mobile cranes.

The British Aluminium Co., Ltd., has transferred its Leeds branch office to Martins Bank Chambers, Vicar Lane, Leeds, 1.

Catalogues and Lists

The Ray Engineering Co., Ltd., Southmead, Bristol.—Illustrated display wall chart of moulded plastic handwheels, handles and knobs.

Lawler, Ayers & Co., Ltd., Broad Street House, 54, Old Broad Street, London, E.C.2. —Illustrated catalogue of "Laco" pipe bending machinery.

Midland Silicones, Ltd., 49, Park Lane, London, W.1.—Three technical data sheets relating to "Silastomer" silicone rubber-covered glasscloth tapes.

Robert Jenkins & Co., Ltd., Rotherham, Yorks.—Illustrated catalogue depicting a wide range of domestic boilers, mixers, condenser shells, galvanized tanks, etc.

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Crectalite" industrial reflectors.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

New Books

Higher Industrial Production with Electricity (Pp. 146; 104 illustrations). British Electrical Development Association, 2, Savoy Hill, London, W.C.2. Price 8s 6d.

This is the first volume of the Association's "Electricity and Productivity" series. Its purpose is to show the industrialist how by the intelligent use of electric power (not necessarily more power) he can improve his production methods in many directions.

After an introduction dealing in simple language with electrical terms in common use, a comparison of British and American industry is made to show how much remains to be done here in industrial electrification. The second chapter relates the electrical installation to the factory layout and processes.

Subsequent sections deal generally with lighting, motors and control gear, materials handling, furnaces and heat treatment, welding, and electrical testing and inspection. The final chapter indicates the advisory services available to the industrialist from E.D.A. and the Electricity Boards.

Manufacturers of all classes of goods should find something of value in this volume and be encouraged to look for further guidance in the application of electrical methods to their particular processes.—J.H.C.

Worked Examples for Advanced Electrical Students. By D. I. Williams, A.M.I.E.E. Pp. 160; figs. 118; index. E. & F. N. Spon, Ltd., 15, Bedford Street, W.C.2. Price 18s.

To succeed in an examination in technical science, it is not sufficient to understand the fundamental principles involved, the candidate must also be able to work correctly numerical examples illustrating the application of the principles in practice. The majority of text-books endeavour to meet this requirement, but unless the book is to become unduly large and costly, the amount of space available for this vital part of study is of necessity strictly limited. The author of this excellent volume is therefore justified in suggesting that it fills a gap in the lists of standard works for technical colleges.

It is assumed that the reader already has a sound knowledge of the basic principles covering those branches of electrical engineering science included in the syllabus of the examination for the Higher National Certificate and Section B of the examination for Associate Membership of the I.E.E., and the examples presented have been arranged in five chapters covering a.c. circuits; transformer working; the induction motor; the alternator and synchronous motor; and d.c. machines.

Each example is prefaced by a brief survey of the theory involved, and in its solution the object in view is to set the student thinking by providing him with the necessary analytical steps between the problem and its answer. Where required, simple diagrams are given, these being not only helpful in the solution of the problem but a joy to the heart of the examiner with corresponding benefit to the candidate. The value of the book would, we think, be enhanced if some additional problems with answers had been included at the end of each chapter.—A.R.

Electric Traction, Lifting and Conveying. Edited by E. Molloy. Pp. 164 and index. George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2. Price 17s.

It is perhaps inevitable in a collective work such as this that there should be some dissonance on account of the different viewpoints of and treatments by the various authors, particularly when such different subjects as traction, lifting and conveying are grouped. We felt this upon reading the first section, "A Survey of Modern Electric Traction," by F. H. Beasant, B.Sc., A.M.I.E.E., which explains series motor characteristics and tractive effort and vehicle resistance curves so lucidly for the practical man. We felt that it was a pity that this section could not have been amplified so that it could have been the single subject of one volume.

Many readers will wish that "Lifting" could have been expanded beyond "Electric Crane Control Gear," "Lifting Magnets" and "Electric Lifts and Control Gear," and that "Conveying" had not been almost confined to escalators.

Lest these comments should be taken as other than constructive criticism, however, we stress that the keynote throughout the book is maintenance and repair, and in this field it should be welcomed because of the very practical treatment.—P.W.T.

MANUFACTURING PROGRESS, 1952

Bruce Peebles & Co., Ltd.

STARTING with the greatest ever uncompleted order book, Bruce Peebles & Co., Ltd., received additional orders during the year for a wide range of electrical plant. Large rotating electrical machines in hand varied in output from 2,160 kVA up to 24,700 kVA and were required for power stations at home and in Australia, New Zealand and Norway.

Other large rotating machines which were in various stages of design and manufacture included a second 11,111 kVA hydro-electric generator and a 10,000 kVA synchronous condenser for New Zealand; for Norway two 14,000 kVA, one 5,200 kVA and two 2,700 kVA hydro-electric generators; and for Australia three 16,380 kVA synchronous condensers.

Orders completed included a 15,000 kVA synchronous condenser and a generator (11,111 kVA) for hydro-electric schemes in New Zealand; several hydro-electric generators of up to 5,200 kVA for Norway; and a 3,125 kVA geared turbo-alternator for the West Indies.

For opencast mining in England a 1,500 kW frequency booster, believed to be the largest machine of its kind to be built in Britain, was completed and commissioned.

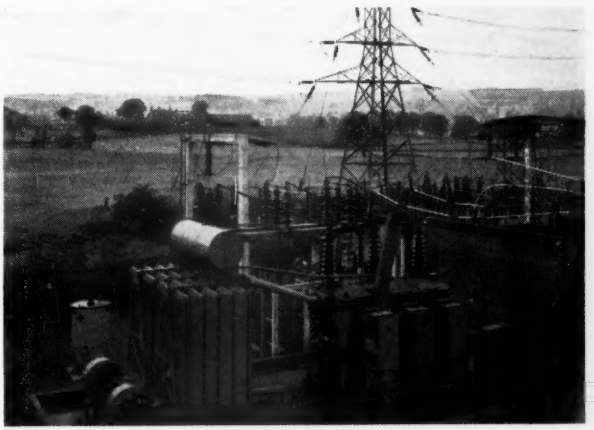
In the export field hydro-electric plant took first place in the company's activities, and such plant commissioned included a 4,300kVA unit at Alta, Norway; two 1,875 kVA equipments at Clowhom Falls, Canada; two 957 kVA sets at Nelspruit, South Africa; and a 625 kVA set at Kerry Falls, Scotland.

Hydro-electric plant in hand for various schemes in Scotland covered machines of up to 24,700 kVA, and in some cases the contract carried full responsibility for the whole of the work on both the electrical and hydraulic sides.

The production of electric motors was maintained at a high level, and large shipments abroad were made of large low speed motors for various factories and of flameproof motors for oil refineries and collieries. Numbers of low speed a.c. motors were demanded in sizes up to 2,250 h.p. for installation in Scotland and England and for South Africa, Australia, Canada and the Gold Coast.

Large motors ordered for industrial use included 7,700, 1,700, 1,000 and 960 h.p. induction motors and 2,250, 1,500 and 1,200 h.p. synchronous induction motors for driving compressors and pumps. Less spectacular, but nonetheless important, were motor orders received from Australia, New Zealand, South Africa, Palestine, Venezuela, Yugoslavia, Argentina and India.

The year also brought an increased demand for large power transformers, and those in various stages of design and manufacture covered units of from 10,000 kVA up to 120,000 kVA for the existing 132 kV British



Transformer contracts included one for two 37,500 kVA generator transformers for Clyde's Mill power station, S.W. Scotland

grid and for the new 275 kV super grid. The British Electricity Authority purchased a large quantity of transformers of which a total capacity of well over 250,000 kVA was completed for various Areas and Divisions in sizes up to 30,000 kVA and for voltages up to 132 kV.

Many of the largest transformers were dual rated with self-cooling at the lower outputs and temperature controlled forced cooling at the higher outputs, and were provided with automatically controlled voltage regulating apparatus. In specified instances they were subjected to impulse tests with recurrent oscillograph equipment.

Transformers totalling well over 100,000 kVA in capacity were supplied to the North of Scotland Hydro-Electric Board, and these included a great many pole-mounting and distribution equipments, in addition to transmission transformers of up to 30,000 kVA.

For the National Coal Board large numbers of transformers for use above and below ground were completed for mines throughout the country and a large number of 1,500 kVA air cooled transformers, each mounted in a transportable cubicle, were completed for a Government establishment.

Transformers completed for overseas included two 16,670 kVA and four 7,500 kVA units for the Owen Falls hydro-electric scheme of the Uganda Electricity Board; sixteen 4,575 kVA rectifier transformers for railway electrification in South Africa; and a total of 76,000 kVA of transformers for various supply authorities in Canada.

Other outstanding examples of transformer contracts include a 72,000 kVA generator transformer for Portobello power station, one 72,000 kVA and two 37,500 kVA generator transformers for Clyde's Mill power station, two 45,000 kVA units for the London Area, and two 30,000 kVA, a 15,000 kVA and five 10,000 kVA transformers, all for the B.E.A.

An important engineering development last year was the further progress made on the Manchester–Sheffield–Wath railway electrification scheme in which the company is responsible for the supply of nineteen 2,500 kW 1,500 V d.c. rectifier substation equipments.

Orders received for glass bulb rectifiers covered medium output equipments for various industrial concerns, and additional orders came from the National Coal Board for thirty mobile battery charging rectifiers for use in connection with underground locomotives.

Work completed by the Welding Department during 1952 covered a wide field. As manufacturers of electrical plant on which welded construction can be profitably used, there were heavy demands from other sections of the works for fabrications of various sizes and kinds such as transformer tanks, stator frames, rotor spiders, bedplates and rectifier cylinders. In addition, a large volume of work was completed for direct supply to customers, which included switch and transformer tanks, bridges for press brakes, turntables, mixing machine frames, and tanks for chemical works.

N.C.B. SPECIFICATIONS

Simplification of Requirements

THE acute need in the coal mining industry for a greater measure of standardization of equipment and component parts has stimulated the National Coal Board to endeavour to simplify its requirements and to prepare specifications of its own, specifying in many instances more precise dimensional standardization, or preferred sizes, than is the practice of British Standard Specifications.

The primary purpose of this policy is to guide management, engineers and supply officers, but in time, if and when the supply position improves, the organization of purchasing and stores procedure will be simplified, while the gradual elimination of numerous varieties of equipment doing the same job will enable stocks to be reduced so that manufacturers will derive similar benefits to the ultimate advantage both of themselves and of the Board. The Board welcomes the advice and assistance of manufacturers in the preparation of specifications, but it must not be assumed that the issue of a specification will mean that all purchases will be in accordance with that specification.

The first seven specifications which have already been issued, price 1s each, are as follows:—P.3/1950: Flameproof air-break electrically operated gate end box, size 1, and P.4/1950 for size 2. P.7/1950: Flameproof air-break circuit breaker. P.8/1950: Air-cooled flameproof single-phase lighting transformer gate end box for M.T. supply. P.9/1950: Flameproof air-break electrically operated 50 c/s drill gate end box, and P.10/1950 for 150 c/s. P.24/1951: High tensile electrically welded steel conveyor chain.

All these specifications can be obtained from the National Coal Board, Hobart House, Grosvenor Place, London, S.W.1.

ELECTRICITY SUPPLY

S.E. Board Raises Minimum Fixed Charge

Scottish Restricted-Period Tariff

FROM 1st April fixed charges of less than £2 12s per annum under the South Eastern Electricity Board's domestic two-part tariffs are to rise to that figure. This is a first step in making the scales of fixed charges uniform. The running rate of 1d remains unaltered. Minimum flat rates for cooking, heating and power are to rise from 1¾d to 2d/kWh (2¼d prepayment meter supplies) and similar adjustments will be made in certain block tariffs. Half a million householders in the Area are already paying fixed charges of £2 12s per annum or more and for most of the 200,000 affected the increase will be 3d a week or less. For a few, however, whose present fixed charges cover only a small part of the cost of giving supply, increases will be greater. Many consumers are already paying the new minimum flat rates for cooking, heating and power and will not be affected. Flat rates for lighting remain unaltered.

In a statement on the revisions, Mr. Norman Elliott, chairman, says that the Board has sought to relate tariffs more closely to the cost of giving supply and has removed some anomalies. As a result a few consumers will pay less than at present. The South Eastern Electricity Consultative Council has been given full information about the Board's costs and has accepted the need for the increases in charges.

B.E.A. Borrowings

A Statement of Guarantee given by the Treasury under Section 42 (1) of the 1947 Electricity Act covers borrowings by the British Electricity Authority for the first quarter of this year up to a total of £110 million.

Rural Development

The Merseyside and North Wales Electricity Consultative Council last year received from the Board its proposals for the third stage of the rural development programme. These proposals were referred to the Local Committees covering the area in which rural development is taking place (mainly North Wales) and have been examined very carefully by them. During the examination, representations which had been received from local authorities, national and local organizations and individuals, were considered, in conjunction with the Board's proposals. At its meeting on 21st January the Council considered recommendations on the proposals and approved the development of specified sections, at the same time making recommendations regarding certain other areas which were not included, but which, in the opinion of the Local Committees and the Council, merited further examination by the Board.

Capital Contributions

The South Wales Electricity Consultative Council, at its meeting in Cardiff on 26th January, heard the Area Board's observations on a suggestion which the Council had made last year that payment of capital contributions for mains and services by way of a fixed annual charge should be incorporated in the scheme as an alternative to the present deferred payment basis.

The Board said that this method of payment was taken into consideration when the standardization of connection charges was undertaken. The present scheme had only been in operation since 21st September and the Board thought it essential to obtain practical experience of its operation before considering any possible amendments. The Board therefore suggested

The first of the B.T.H. 275 kV super-grid transformers en route for Staythorpe power station (see *Electrical Review*, **30th January, page 277**)

that consideration of the Council's proposals should be deferred.

Councillor S. O. Thomas (Carmarthen) said he believed that the Board would be assisting the farmer if it adopted the Council's suggestion. Remarking that the size of the average farm in Wales was only 46 acres, he said that the small farmers were having to use all available capital for the implementation of the food expansion programme. That meant difficulty in finding the necessary capital contributions for the installation of electricity. The suggested method would be conducive to the use of more electricity on the farms. He asked that when the Board considered the whole question it should bear his point in mind.

Representations Against New Tariff

The South Wales Consultative Council received a deputation from the Cardiff City Council to make representations about the electricity tariff for domestic consumers. The representations, which covered thirteen foolscap sheets of typescript, said protests against "the grievous injustice" inflicted by the new domestic tariff upon consumers least able to bear such increased charges, had been received by the City Council.

The deputation contended that the new proposals were bad in principle because no alternative form of tariff was provided. Consumers should be given options as to the tariff they desired to adopt, and on this point the Electricity Commissioners' 1930 report was mentioned. The City Council also claimed that the official announcements of the new proposals misled the public by referring to the prospective *moderate* increases in charges. The adoption of a room basis did not have regard to the factor of ability to pay. The City Council was also concerned about the Board's proposals for new tariffs for electricity supplied for public lighting which were considered unreasonable.

The deputy chairman of the Consultative Council, Mr. G. L. Curnow, said the representations would be referred to the Tariff Committee.

S.W. Scotland Tariffs

The South West Scotland Electricity Board is putting into operation on 2nd March a restricted-hour tariff for the purpose of encouraging consumers to make a greater use of electricity at times when supplies are plentiful. The price under the new tariff, including the adjustment for coal, will be 0·755d kWh for l.v. supplies or 0·73d/kWh for supplies metered at 6,000 V or more. These rates will apply to supplies which are taken only during the night or at week-ends, or between noon and 3 p.m.

As from 2nd March there will be increases in the Board's domestic and farm tariffs. In the case of domestic tariffs the primary rate will be raised from 4d to 4½d/kWh (3½d to 4d in Glasgow and Rutherglen) for credit meter supplies and the number of primary units will be increased from 13 to 15 per room per quarter for all credit and prepayment meter supplies. The primary rate of 6d for prepayment meters remains unchanged. In the case of the farm tariff the primary rate is increased from 4d to 4½/kWh and the number of primary units under each head of assessment from 13 to 15 per quarter. The secondary rate of 0·875d kWh remains unaltered.

Wakefield Power Station Site

An appeal by the British Electricity Authority to the Ministry of Housing and Local Government was the subject of an inquiry last week. The *Manchester Guardian* reports that two inspectors from the Ministry examined the proposed site for a new power station on the River Calder, near Wakefield. The B.E.A. proposed to use water from the Calder for cooling purposes and return it at an average temperature of 70 deg F, with a maximum at any time of 90 deg F. The River Board ruled that the temperature should not be raised by more than 2 deg when the river was already at 60 deg. It is stated that the Board's requirement would involve an addition of £175,000 to the capital expenditure of £12·5 million and an increase of £43,000 a year in the running costs.

B.E.A. Contracts

Contracts have been placed by the British Electricity Authority during the past month for equipment for power stations, transforming stations, and transmission lines, amounting in the aggregate to £7,418,676. The principal contracts include the following:—

Marchwood power station, near Southampton: Four 550,000 lb/hr boilers—John Thompson Water Tube Boilers; and 3·3 kV switchgear and accessories—English Electric Co.

Goldington station, Bedford: Coal handling plant—International Combustion.

Tilbury station: High pressure piping equipment—John Thompson Water Tube Boilers.

Meaford station, Stone, Staffs.: One 60 MW turbo-generator—British Thomson-Houston Co.; condensing and feed heating plant for one 60 MW turbo-generator—Hick Hargreaves & Co.; 3·3 kV and 415 V switchgear and accessories—A. Reyrolle & Co.; and 2,500 MVA 132 kV switchgear—General Electric Co.

Uskmouth station, Newport: Main and auxiliary cables and connections—Pirelli-General Cable Works.

Bold station, St. Helens: Two 30 MW turbo-generator sets—Metropolitan-Vickers Electrical Co.

Ince station, near Ellesmere Port: High pressure pipework and valves—Babcock & Wilcox.

Keadby station, Scunthorpe: 3·3 kV switchgear—English Electric Co.

Stella North station, near Newcastle-upon-Tyne: Ash handling transporter—Strachen & Henshaw.

Stella South station: 3·3 kV and 415 V switchgear and accessories—A. Reyrolle & Co. Ash handling transporter—Strachan & Henshaw.

Chadderton station, Oldham: Coal handling plant superstructure—Fred Mitchell & Son.

Huncoat station, Accrington: Structural steelwork—Simon-Carves.

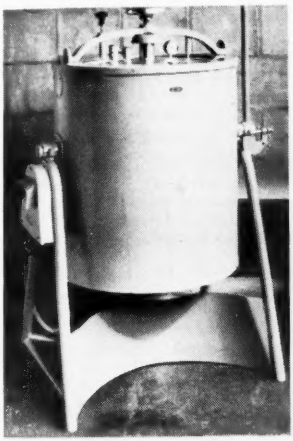
Clyde's Mill station, Glasgow: Condensing and feed heating and evaporating plant—Mirrlees Watson Co.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Farm Food Boiler

A PRESSURE-TYPE boiler, a development from the range of farm food boilers which has been in use for several years, is being offered by HEATRAE, LTD., Heatrae Works, Norwich. Made in one size (nominally 36 gall) with a standard loading of 6 kW, it is designed for a working pressure of 10–12 lb/sq in. The lid



Heatrae pressure-type farm food boiler

for making the enclosure steam-tight is of the internally fitted pattern and cannot be removed unless the pressure has been reduced to zero.

Two switches are built into a small panel attached to the stand on which the boiler tilts, one controlling 4 kW and the other 2 kW. When first switched on, the full loading of 6 kW is used, but as soon as the working pressure of 10 lb/sq in has been obtained, the loading is automatically reduced to 2 kW to maintain the pressure.

The boiler can be used for processing any class of farm foods, including pig swill, the weight depending upon its nature, normally in the region of $1\frac{3}{4}$ to 2 cwt. Actual time required to bring the boiler up to pressure and maintain it for one hour is under four hours and the consumption is rather less than 8 kWh/cwt. The boiler weighs approximately 350 lb and the working height is 46in. It is suitable for use on 200/250 V a.c. supplies and the price of the complete equipment is £77.

Explosively Powered Hammer

The "Rapid Hammer R.IV." explosively powered hammer has been designed as a universal tool able to serve bolts of 6 mm and 10 mm by simply using the relevant barrel. It is of an entirely new design with no recoil on operation and with the same three well-proved safety devices as are incorporated in earlier models. The tool is unbreakable and not trigger operated. The distributors are ADAM & HARVEY (RAPID HAMMER), LTD., Greenwich House, 10–13, Newgate Street, E.C.1.

Roadway Beacons

Two new battery operated portable "Geopi" flashing beacons have been introduced by GEORGE PIKE, LTD., Alma Street, Birmingham, 6. One is of the directional type, a cowl confining the signal to oncoming traffic, while the other is fitted with a domed glass top allowing the light to be seen from all angles. Both units consist essentially of an angle-iron frame divided into two compartments housing the controller and the 12 V 85 Ah "Exide" battery respectively. The lighting unit of the directional beacon comprises an 8in diameter amber coloured diffusing lens mounted in a roundel door with an 8in cowl backed by a rubber gasket. The non-directional model is similar in construction but has a glass dome protected by a mesh guard in place of the cowled amber lens. Lenses of any colour may be employed and both units flash 42 times a minute for 36 hours on one full battery charge.

"Geopi" directional and non-directional battery operated portable beacons

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

The General Cable Manufacturing Co., Ltd., held its annual meeting on 30th January, when Mr. C. W. R. Pantlin (chairman) said that they made steady progress throughout the year, the turnover being substantially higher, and at the same time the scope of their trade was developed both in the home and export markets, while all Service requirements for the rearmament programme were met. During the year the prices of a number of raw materials fell, but, unfortunately, this did not apply to copper, and the current controlled price was £58 per ton higher than a year ago. As copper represented such a large proportion of the prime cost of cables, the addition had to be passed on to the consumer.

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., reports a group net profit for the year ended 30th September last of £140,665, as compared with £184,080 for 1950-51, after providing £216,354 for taxation. It is proposed to pay the fixed dividend of 6 per cent for the year on the preferred ordinary and an additional 2 per cent, and a dividend on the ordinary capital of 6 per cent and an additional 3 per cent. These dividends are the same as for the previous year.

Cable & Wireless (Holding), Ltd., reports a group profit, before taxation, for 1952 of £635,000, as compared with £636,687 for 1951, and after deducting £316,000 for taxation, there is a net balance of £319,000 (against £373,175). It is proposed to pay a final dividend on the ordinary stock of 3 per cent and a bonus of 2 per cent, maintaining the distribution for the year at 8 per cent. General reserve receives £100,000.

The Superheater Co., Ltd., has announced a scrip issue of one 5s "A" ordinary share for every six ordinary and/or "A" ordinary held. The issue will require 176,400 "A" ordinary shares. An extraordinary meeting will be held on 12th March to pass the necessary resolution.

Aberdare Cables (Holdings), Ltd., is paying a second interim dividend (to be considered as a final dividend) of 15 per cent (against 10 per cent), making 25 per cent for the year (20 per cent).

Hick, Hargreaves & Co., Ltd., propose to increase their capital and to offer 48,000 £1 shares at 52s 6d each on a one-for-six basis. The new shares will not participate in any dividend in respect of the year to 31st March next.

The Morgan Crucible Co., Ltd., is paying an interim dividend of 3¾ per cent, the same as last year.

New Companies

Lewis Powell (Neon Services), Ltd.—Registered 9th January. Capital £100. Electrical and electronic engineers and contractors, manufacturers of neon tubing and signs, etc. Directors: L. H. Powell, G. Powell and E. Smith. Regd. office: 4, Crown Point Street, Leeds, 10.

Bloo-Bar Products, Ltd.—Registered 17th January. Capital £100. Electricians, electrical and mechanical engineers, etc. L. Bloom signs as director. Solicitors: Dunderdale Wignall & Co., Manchester, 2.

Cytrigan Neon Co., Ltd.—Registered 17th January. Capital £200. Manufacturers of and dealers in brilliant sign letters and neon signs, etc. Directors: J. G. Fovargue (director of Chrysler Garages (Kettering), Ltd.) and S. G. Horton. Secretary: J. G. Fovargue. Regd. office: Bayes Street, Kettering.

S. & R. Wholesale (Bradford), Ltd.—Registered 28th January. Capital £100. Wholesale suppliers and distributors of and dealers in electric motors and motor control gear, switchgear, armatures, etc. Directors: A. Southern, F. N. Wardman, W. Womersley and K. A. Wood. Solicitors: Norman Lee, Armistead & Roberts, Bradford.

Delta Electric, Ltd.—Registered 21st January. Capital £1,000. Manufacturers, repairers and designers of and dealers in engineering and electrical apparatus, appliances and machinery, etc. Subscribers: C. W. Cooper, 3, Oak Road, Bedford, engineer, and J. R. Slatter, A.M.I.E.E., A.M.I.Mech.E., Brelades, Stagsden Road, Bromham, Beds.

Cinetronics, Ltd.—Registered 21st January. Capital £500. Designers, manufacturers of and dealers in radio, television, electrical and electronic apparatus and supplies, etc. Directors: J. W. H. Kemsley, Mrs. Evelyn L. Kemsley and A. E. Wiltshire.

Secretary: E. P. Cook. Regd. office: Imperial Studios, Boreham Wood, Herts.

Neon Lights (Edinburgh), Ltd.—Registered in Edinburgh 17th January. Capital £100. Manufacturers of neon lighting, etc. Directors: W. Spiers, A. Walker and J. Dickson (secretary). Regd. office: 95, West Regent Street, Glasgow.

Increases of Capital

Uni-Tubes, Ltd.—Increased by £26,125, in £1 ordinary shares, beyond the registered capital of £23,875. The 5,500 issued ordinary shares of 5s in the original capital have been consolidated and divided into 1,375 shares of £1 each, and the 4,500 issued preference shares of 5s each have been converted into ordinary shares and subdivided into 22,500 shares of £1 each. On 3rd April, 1952, Kopex Maschinen A-G of Zürich held all the issued preference shares.

Coventry Electrical Appliances, Ltd.—Increased by £10,000, in £1 ordinary shares, beyond the registered capital of £10,000.

Ritchie & Co. (Electrical Contractors), Ltd.—Increased by £5,000, in £1 ordinary shares, beyond the registered capital of £3,000.

Pioneer Telephone Manufacturing Co., Ltd.—Increased by £40,000, in £1 ordinary shares, beyond the registered capital of £15,000.

Liquidation

Crown Lane Radio, Ltd.—Meetings of members and creditors on 23rd February at 100, Park Street, Grosvenor Square, London, W.1, to receive an account of the winding-up by the liquidator, Mr. D. Morgan.

Bankruptcies

T. Riley, lately carrying on business at 58, Station Road, Tunstall, Stoke-on-Trent, electrical contractor.—Last day for receiving proofs for dividend 11th February. Trustee, Mr. F. C. Ormrod, 12, Lonsdale Street, Stoke-on-Trent. Official Receiver.

S. E. Jones and **G. W. A. E. Short**, carrying on business at Elsecar, near Barnsley, Yorks, under the style of S. E. Jones & Co., as dry battery manufacturers.—Order of adjudication dated 25th January, 1928, annulled, receiving order made 25th January, 1928, rescinded, and petition filed 25th January, 1928, dismissed, debts having been paid in full.

D. Cromwell and **V. I. Cromwell**, carrying on business in partnership under the style of Cromwell & Co., at the rear of 76, High Street, Croydon, Surrey, and formerly at Hindsley Works, Hindsley Place, Forest Hill, London, S.E.23, and at a garage in Combe Avenue, Croydon, and at Streatham Hill, S.W.2, manufacturers of electrical fittings, lamp shades and a food product.—First and final dividend of 1s 8d in the £, payable on and after 24th February at 32, Queen Anne Street, London, W.1.

D. Cromwell (separate estate).—First and final dividend of 10s in the £, payable on and after 24th February at 32, Queen Anne Street, London, W.1.

V. I. Cromwell (separate estate).—First and final dividend of 1s 6d in the £, payable on and after 24th February at 32, Queen Anne Street, London, W.1.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to the dates mentioned.

21st February

MINIMAC. No. 710,353, Class 9. Electric switches.—Simplex Electric Co., Ltd., Broadwell Road, Oldbury, Birmingham.

CHESMET. No. 712,883, Class 9. Electric batteries, and parts thereof included in Class 9; and electrical safety fuses.—L. A. Lethbridge Ltd., trading also as Diamond Distributors (Cheshunt), 193, Windmill Lane, Cheshunt, Herts.

CUE TIME. No. 713,167, Class 9. Sound recording and sound reproducing apparatus and instruments, but not including sound producing records.—Bishop Sound & Electrical Co., Ltd., 48, Monmouth Street, London, W.C.2.

UNITY. No. B708,374, Class 11. Installations and contrivances for heating, lighting, ventilating, air-conditioning and drying; and kilns.—Unity Heating Ltd., Chilworth Manor, Southampton.

28th February

MATOM. No. 709,786, Class 7. Electrically operated chain pulley blocks.—Geo. W. King, Ltd., Hartford Works, Walsworth Road, Hitchin, Herts.

No. 711,300 (design), Class 9. Electric circuit breakers and electric switches.—Mechanical Products, Inc., Michigan, U.S.A. Address for service, c/o J. A. Kemp & Co., Bank Chambers, 329, High Holborn, London, W.C.1.

ASHAVIN. No. 713,035, Class 9. Cables included in Class 9.—Shardlow Electric Wires, Ltd., Moseley Buildings, 56, Moseley Street, Manchester.

CELSONIC. No. 713,253, Class 9. Sound recording apparatus, microphones, electrical and electronic apparatus for selecting and sorting metal, and parts included in Class 9 for all such goods.—Excel Sound Services, Ltd., Norwood Works, off Norwood Avenue, Shipley.

SONOSCRIBE. No. 713,268, Class 9. Electrical and magnetic sound recording and sound reproducing apparatus.—Hartley Electromotives, Ltd., 1a, Harrington Road, London, S.W.7.

DORMAN DIO-PAL. No. 711,064, Class 11. Electric lighting fittings.—Dorman & Smith, Ltd., Ordsal Electrical Works, Salford, 5.

CERACE. No. 713,013. CEREGAL. No. 713,014. Both Class 11. Carbons for electrical purposes.—Charles H. Champion & Co., Ltd., National House, 60-66, Wardour Street, London, W.1.

AURELIA. No. 713,347, Class 11. Dynamo lighting sets and parts thereof included in Class 11.—Evian (G. B.), Ltd., 9, Drapers Gardens, Throgmorton Avenue, London, E.C.2.

CATHOMAG. No. 713,442, Class 11. Electric lamps.—De Vere (Kensington), Ltd., 83, Bellenden Road, Peckham, London, S.E.15.

STOCKS and SHARES

INDUSTRIAL markets of the Stock Exchange are consolidating satisfactorily the general advance of prices that took place during January. In many cases further gains can be recorded, although there has been nothing spectacular in price movements except at a few isolated points where "take-over" bids have been—or may be—made for the shares of individual companies. These occasions, which are a novel and interesting feature of markets at present, seem generally to arise in cases where outside interests take the view that the market value of certain shares has been unduly repressed by, for instance, an ultra-conservative dividend policy, or by unrealized potentialities in the assets.

Cable & Wireless Dividend

The Cable & Wireless (Holding) Company's final dividend and bonus satisfied most market expectations in bringing the distribution for the year up to a total of 8 per cent, the same rate as that of a year ago. A moderate contraction shown in the preliminary profits statement would presumably account for a subsequent drop of 4 points to 127½ in the price of the ordinary stock. The fall of £54,000 in the net surplus of £319,000 is, however, largely accounted for by higher tax charges. It appears, also, that income must have suffered through the realization of investments to provide for repayment of the 3½ per cent loan stock, the outstanding amount of which was, in the end, replaced by the new 5 per cent debentures. In any event, the distribution of £210,000 net in dividend is still well within the available surplus, of which £100,000 is to be transferred to reserves.

Bylock Electric

The 1s ordinary shares of Bylock Electric have lately come in for attention, the result being a rise in the price, during the last week or two, from 5s 3d to 6s. This is more than double the lowest price quoted last year. Interest in the shares is said to be connected with some of the company's latest domestic appliances and also with the dividend and results, due before long, in respect of the year ended last July. For the previous twelve months, dividends on the ordinary capital of £15,000 totalled 50 per cent. No interim dividend was paid for the latest period, in view of uncertainties in the outlook, although experience during the first six months was reported to indicate results up to the previous figures. On the basis of last year's rate of dividend, the yield on the shares is 8½ per cent.

Aberdare Cables Payment

The 5s ordinary shares of the Aberdare Cables (Holding) Company were marked up to 16s 3d on satisfaction with the declaration of a second interim dividend of 15 per cent. This, in effect, takes the place of a final distribution and, together with the first interim, makes a total of 25 per cent for the year ended last October, or 5 per cent more than was paid for the previous twelve months. Some of the other cable manufacturers' shares also improved. London Electric Wire and Scottish Cable ordinary particularly being in good demand up to prices of 56s 3d and 12s 3d respectively. Telegraph Construction were firm on news of the company's supplying its new-type cables to the Copenhagen Telephone Company.

Price Changes

Associated Electrical Industries have risen by a further 1s 3d over the past week, and advances of 1s or more in Murex and International Combustion witness also the special popularity of shares on which the latest dividends were heavily covered by available earnings. C. A. Parsons have been changing hands at around 61s 9d. Decca added 9d to the previous week's gain of 2s, in advance of the annual results. Cossors at 10s 3d and Plessey at 23s also showed up well. Among the lower-priced shares to show useful appreciation were Aerialites, 1s up at 9s 6d, Dictograph Telephones 5s 6d, Holophane 11s 6d, Thorn Electrics 8s 3d, and Allen West at 10s 9d.

Preference Shares

Under the influence of a firm gilt-edged market, the prices of industrial preference shares have been quietly advancing during recent months. Matters have again reached the stage at which the investor in the most popular issues does not see much more than a 5 per cent return on his money. Yields are indeed a little below that figure in the case of such preference issues as Reyrolle 4 per cents at 16s 6d, A.E.I. 4½ per cents at 18s 6d, and B.I.C. "sixes" at 24s 6d. Among preference shares recently on offer to yield between 5 and 5½ per cent were the 5 per cent issues of Ferranti and Pye, at 19s 6d and 18s 9d respectively, and the 7½ per cent shares of London Electric Wire and G.E.C., both at about 28s 6d. E. K. Cole 5½ per cents are available at a few pence below par (20s). Brush Electric 5½ per cent preference at 16s 9d pay 6½ per cent, and Cossor "sixes" at 17s 6d give 6¾ per cent. A return of 7 guineas per cent is shown on Telephone Properties 8 per cent preference, on offer at 22s 3d.

ELECTRICAL INVESTMENTS

Past Week's Price Changes

Company	Dividend Previous	Dividend Last	Middle Price 2nd Feb. 1953	Week's Rise or Fall	Est. Yield p.c. £	s	d
Gilt-edged and Overseas Stocks							
Brit. Elec. 1968/73	3	3	85	—	3	10	7
Brit. Elec. 1974/77	3	3	84	—	3	11	5
Brit. Elec. 1976/79	3½	3½	90	+½	3	17	9
Brit. Elec. 1974/79	—	4½	100½	—	4	4	6
Calcutta Elec. ..	6†	6†	20/-	—	6	0	0†
East African Power	7	7	23/-	—	6	1	9
Nigerian Elec. ..	10	10	21/3	—		—	
Palestine Elec. "A"	5†	Nil	9/-	—		—	
Perak Hydro-Elec.	Nil	Nil	14/6	—		Nil	
Equipment and Manufacturing							
AberdareCables(5/-)	20	25	16/3	+6d	7	13	9
Aerialite (1/-) ..	83½	88½	9/6	+1 -	9	6	0
Allen, W. H. ..	15	15	43/3	+3d		—	
Aron Elec. Ord. ..	15	15	37/6	—	8	0	0
Assoc. Elec. Ord...	20	20	78/9	+ ⅛	5	1	6
Automatic Tel. & El.	15	15	60/-	- ⅛	5	0	0
Babcock & Wilcox	18	18	70/3	−1/9	5	2	6
Baldwin, H. J. (2/-)	25	20	3/6	—	11	8	9
Bakelite (10/-) ..	—	—	16/3	—		—	
British Aluminium	10	12	41/-	—	5	17	1
B.I. Callender's ..	7½	9	34/-	—	5	6	0
British Thermostat (5/-)	30	30	31/-	+3d	4	16	9
British Vac. Cleaner (5/-)	25	25	13/9	—	9	1	10
Brook Motors (10/-)	20	20	32/6	—	6	3	1
Brush Ord. (5/-) ..	10	10	5/-	—	10	0	0
A. F. Bulgin (1/-)..	27½	30	2 7½	—	11	8	6
Burco (5/-) ..	38½	35	18/9	—	9	6	9
Chloride El. Storage	15	15	66/3	—	4	10	6
Cole, E. K. (5/-) ..	25	25*	17/6	—	7	2	10
Cossor, A. C. (5/-)	Nil	10	10/3	+6d	4	17	7
Crabtree (10/-) ..	17½	17½	31/3	—	5	12	0
Crompton Parkinson Ord. (5/-) ..	11½	11½	9/6	—	5	18	5
De La Rue (5/-) ..	50	35*	8/-	−6d		—	
Decca (1/-) ..	112½	112½	20/9	+9d	5	8	6
Dewhurst (2/-) ..	22½	19*	5/-	—	7	12	0
Dictograph Tel. (2/-)	20	20	5/6	+6d	7	5	6
E.M.I. (10/-) ..	12	12	13/6	—	8	17	9
Electrical Components (5/-) ..	20	20	10/-	—	10	0	0
Elec. Construction	15	15	55/-	—	5	9	1
Enfield Cable Ord.	7½	7½	24/-	—	6	5	0
English Electric ..	15	15	60/-	—	5	0	0
Ericsson Tel. (5/-)	22†	22*†	42/6	—	2	11	9†
Ever Ready (5/-)..	35	35	27/3	—	6	8	5
Falk Stadelmann..	15	15	42/-	—	7	2	10
G.E.C. Ord. ..	22½	22½	42/3	—	5	6	6*
General Cables (5/-)	30	30	15/-	—	10	0	0
Greenwood & Batley	15	15	38/-	—	7	18	0
Hackbridge Cable (5/-)	20	20	10/9	—	9	6	0
Hackbridge Hewittic (5/-)	18	20	16/3	—	6	3	0
Hall Tel. Acc. (10/-)	10	10	9/3	—	10	16	2
Heatrae (2/-) ..	12½	12½	4/-	—	6	5	0
Henleys (10/-) ..	20	20	18/6	—	5	8	0
Holophane (5/-) ..	15	20*	11/6	+3d	8	14	0
Hoover (5/-) ..	37½	35*	24/3	−3d	7	4	4

Company	Dividend Previous	Dividend Last	Middle Price 2nd Feb. 1953	Week's Rise or Fall	Est. Yield p.c. £	s	d
Equipment and Manufacturing (continued)							
Intl. Combustion (5/-)	20	25	13/6	+1/-		—	
Johnson & Phillips	15	15	53/9	—	5	11	6
Lancashire Dynamo	22½	12½*	43/9	—	5	14	2
Laurence,Scott(5/-)	12½	15	13/3	—	5	13	3
London Elec. Wire	12½	12½	56/3	+ ⅛	4	9	0
J. Lucas	7½	9½	37/6	—	4	17	9
Marryat & S. (2/-)	22½	22½	5/-	—	9	0	0
Mather & Platt ..	12½	12½	43/9	+6d	5	14	3
Metal Industries ..	10	15	42/-	—		—	
Mid. Elec. Mfg. ..	15	15	55/-	—	5	9	1
Murex	12½	15	57/-	+1/9d	5	5	3
Newman Ind. (2/-)	6	10	2/3	—	8	17	10
Oldham & Son (1/-)	30	35	2/6	—		—	
Parnall (Yate) (5/-)	6	6	3/6	—	8	11	6
Parsons, C. A. ..	15	10*	58/6	—		—	
Plessey (5/-) ..	22½	25	23/-	+1/-	5	8	8
Pye Deferred (5/-)	18	18	17/-	—	5	6	0
Revo (10/-) ..	27½	27½	43/9	—	6	5	9
Reyrolle	15	10*	51/3	—		—	
Scot. Cable (4/-) ..	30	32	12/3	+6d		—	
Siemens Ord. ..	10	10	35/6	−6d	5	12	8
Southern Areas ..	Nil	5	11/-	—	9	1	9
Strand Elec. (5/-)..	17½	17½	8/9	—	10	0	0
Sturtevant (5/-) ..	16½†	17½*†	24/6	−6d		—	
Switchgear&Cowans (5/-)	22½	22½	16/-	—	7	0	8
Taylor T. (5/-) ..	20	20	19/3	—	5	4	0
T.C.C. (10/-) ..	20	20*	38/-	—		—	
T.C. & M... ..	10	10	27/-	—		—	
TelephoneMfg.(5/-)	10	10	8/9	—		—	
Thorn. Elec. (5/-)..	10	12½	8/3	+3d	7	11	6
Tube Investments	25	15*	61/3	—	4	18	0
Vactric (5/-) ..	Nil	Nil	4/6	—		Nil	
Veritys (5/-) ..	Nil	7½	4/9	—	7	18	0
Walsall Conduits (4/-)	70	70	46/6	—		—	
Ward & Goldstone (5/-)	45	45*	31/-	—		—	
Watford (2/-) ..	25	25	6/9	—	7	8	3
Westinghouse Brake	14	14	53/3	—	5	5	2
West, Allen (5/-) ..	12½	15	10/9	+6d	6	19	6
Trusts, Transport and Communications							
Anglo-Am. Tel.: A Ord. ..	—	6	77½	—	7	14	9
Ord.	—	3½	55	—	6	16	3
Anglo-Portuguese	8	8	20/9	—	7	14	3
Brit.Elec.Traction: Def. Ord. ..	22½	25	475	+20	5	5	3
Cable & Wireless: Ord.	6	8	127½	−4	6	5	6
4% Loan ..	4	4	94½	—	4	4	9
Calcutta Trams ..	6†	6†	22/6	—	5	6	8†
Cape Elec. Trams	5	5½	10/-	—	11	0	0
Marconi Marine ..	10	10	31/3	—	6	8	0
Oriental Tel. Ord.	16	16	63/9	+ ⅛		—	
Telephone Props...	8	8	33/9	—	4	14	10
Tele. Rentals (5/-)	10	10	8/9	—	5	14	3

* After capital bonus.
† Dividends are paid free of Income Tax.

NEXT WEEK'S EVENTS

Monday, 9th February

BATH.—Technical College, 6 p.m. I.E.E. Western Centre. "The Characteristics and Control of Rectifier-Motor Variable-Speed Drives," by P. Bingley.

BIRMINGHAM.—Imperial Hotel, 6 p.m. I.E.E. South Midland Supply and Utilization Group. "The Design of High-Speed Salient-Pole a.c. Generators for Water-Power Plants," by E. M. Johnson and C. P. Holder.

Imperial Hotel, Temple Street, 6.30 p.m. Engineers' Guild, West Midlands Branch. Films.

KINGSBURY.—Prince of Wales Hotel, 8 p.m. A.S.E.E. North West London Branch. "Brains Trust."

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "Is Technical Advertising Necessary or Desirable?" opened by W. Bamford.

St. Ermin's Hotel, Caxton Street, S.W.1, 6.45 p.m. A.S.E.E. Central London Branch. "Corrosion and Cathode Protection," by G. G. Portch.

MANCHESTER.—Grand Hotel, 6.45 p.m. Institution of Works Managers, Manchester Branch. "Standardization in Industry," by A. F. B. Nall.

NEWCASTLE-UPON-TYNE.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "The Use of Electricity in a Modern Iron and Steel Works," W. F. Cartwright.

SHEFFIELD.—University, Western Bank, 6.30 p.m. I.E.S. Sheffield Centre. "Specification and Testing of Fluorescent Lamps," by W. R. Bloxsidge.

Tuesday, 10th February

BELFAST.—Presbyterian Hostel, Howard Street, 6.15 p.m. I.E.E. Northern Ireland Centre. "275 kV Developments in the British Grid System," by D. P. Sayers, Dr. J. S. Forrest and F. J. Lane.

BOLTON.—Balmoral Hotel, Bradshawgate, 7.30 p.m. A.S.E.E. Bolton Branch. Lecture.

BRADFORD.—Y.E.B., Sunbridge Road, 6.30 p.m. I.E.E. North Midland Students' Section. "Locomotive Mounted Convertors for Electric Traction," by H. J. Towse.

CARDIFF.—G.E.C. Building, Cathays Park, 6.30 p.m. The Institution of Heating and Ventilating Engineers, South Western Branch. "Automatic Controls for Heating Equipment," by K. Ernest.

LONDON.—At the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, 5.30 p.m. Joint meeting of the I.E.E. and I.Mech.E. "Ignition Interference with Television Reception," by A. H. Ball and W. Nethercot.

2, Savoy Hill, W.C.2, 6 p.m. Illuminating Engineering Society. "Shop Window Lighting," by A. W. Jervis. (Joint meeting with R.I.B.A.)

85, Minories, E.C.3, 5.30 p.m. Institute of Marine Engineers. "Atomic Propulsion, with Special Reference to Marine Propulsion," by Sir John Cockeroft.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Centre, Supply Group. "Some Researches on Circuit-Breaking by Means of High-Voltage Circuit-Breakers, with Special Reference to Current-Chopping," by A. F. B. Young.

Engineers' Club, Albert Square, 7.15 p.m. Incorporated Plant Engineers, East Lancashire Branch. "Instrumentation and Automatic Control for Medium and Small Boilers," by Mr. Klepp.

NEWPORT.—Tredegar Arms Hotel, 7 p.m. Newport and District Electric Club. "Electricity as Applied to Horticulture and Agriculture," by G. H. Purvis.

RUGBY.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre Students' Section. Students' Lecture. "Electrical Safety Precautions," by H. W. Swann.

Tuesday, 10th February, to Thursday, 12th February

CHELTENHAM.—Town Hall. National Power Farming Conference.

Wednesday, 11th February

ABERDEEN.—Caledonian Hotel, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "Topics on the Design and Testing of High-Power Valves," by A. M. Hardie.

BIRMINGHAM.—Grand Hotel, 7 p.m. Purchasing Officers' Association, Birmingham Branch. "Legal Aspects of Purchasing and Sale of Goods Act," by J. Murray Grammer.

Imperial Hotel, Temple Street, 7.30 p.m. Institute of Executive Engineers and Officers, Midlands Branch. "The Interdependence of Administrative, Executive and Technical Staff" (part 2), by Dr. W. Pinner.

BRADFORD.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford Branch. "Factory Maintenance," by J. W. White.

HOVE.—S.E.E.B. Headquarters, 6.30 p.m. I.E.E. Southern Centre. "Earthing," by P. W. Cave.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Radio Section. "A Method of Designing Transistor Trigger Circuits," by Prof. F. C. Williams.

School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, 6.30 p.m. British Institution of Radio Engineers, London Section. "Modern Trends in Communications Materials," by L. A. Thomas.

Savoy Hotel, 7.15 p.m. Institution of Heating and Ventilating Engineers. Annual dinner.

MANCHESTER.—College of Technology, 6.45 p.m. Manchester Association of Engineers. Eighth Manchester Association of Engineers' Lecture, by Sir Arthur P. M. Fleming.

NEWCASTLE-UPON-TYNE.—Neville Hall, Westgate Road, 6 p.m. British Institution of Radio Engineers, North Eastern Section. "Design Considerations of a Commercial F.M. Receiver," by F. H. Beaumont.

NOTTINGHAM.—Welbeck Hotel, 7 p.m. Incorporated Plant Engineers, East Midlands Branch. "An Approach to Maintenance—the Report of the U.K. Specialist Team on Plant Maintenance," by H. G. Hilton.

OXFORD.—37, George Street, 7 p.m. I.E.E. District Meeting. "Colour Television," by G. G. Gouriet.

PRESTON.—Harris Institute, Corporation Street, 7 p.m. I.E.E. North Lancashire Sub-Centre. Discussion on "Electric Traction, with Special Reference to Single-Phase Working," opened by H. Charnley.

Bull & Royal Hotel, 7.30 p.m. A.S.E.E. Preston Branch. "Aluminium Cables," by F. T. Aldridge.

SLOUGH.—Reindeer Inn, 7.15 p.m. Purchasing Officers' Association, Slough Branch. "Industrial Organization and Current Trading Conditions," by W. A. M. Edwards.

Thursday, 12th February

DUNDEE.—Royal Hotel, 7 p.m. I.E.E. North of Scotland Sub-Centre. "Topics on the Design and Testing of High-Power Valves," by A. M. Hardie.

KENTON.—"The Plough," Kenton Road, 12.30 p.m. Institution of Works Managers, Wembley Sub-Branch. "Engineering for Manufacture," by A. J. Cowdroy.

LIVERPOOL.—Electricity Showroom, Whitechapel, 7 p.m. E.P.E.A. Merseyside Technical Group. "Earthing of Electrical Systems and Equipment," by F. Mather.

LONDON.—Polytechnic, Regent Street, W.1, 7.30 p.m. Institute of Industrial Supervisors, London Central Section. "Aspects of Factory Economics," part 1, by F. J. Anscomb and L. Kew.

MANCHESTER.—Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. "Lamps and Lighting for Inspection," by H. R. Ruff and H. E. Bellchambers.

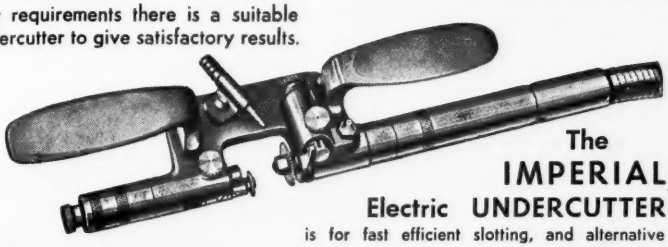
NEWCASTLE-UPON-TYNE.—Old Assembly Rooms, 7 for 7.30 p.m. I.E.E. North-Eastern Centre. Annual dinner and dance.

SWANSEA.—Central Public Library, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. Discussion on "Earthing," opened by R. B. Rowson, J. Wright and N. C. Jones.

(*Continued at foot of page* 335)

MARTINDALE MICA UNDERCUTTERS

Whatever your requirements there is a suitable Martindale Undercutter to give satisfactory results.



The
IMPERIAL
Electric UNDERCUTTER
is for fast efficient slotting, and alternative heads and handpieces can be used for driving rotary burrs, files, mounted grinding points, polishing mops, wire brushes, sanding discs, etc.

It is a most efficient electric machine for both portable and shop use for commutators 6" diameter and upwards.

The
PNEUMATIC
UNDERCUTTER
is basically the same construction as the Imperial but is driven by a sturdy high-speed air motor operating at about 100 lbs. per sq. inch.

Descriptive leaflets from:

MARTINDALE ELECTRIC CO. LTD., 4 Westmorland Road, London, N.W.9

"Off the shelf service"

for

M.E.M. AND SANDERS

Switch & Fuse Gear

"Memspan"

DOMESTIC AND INDUSTRIAL
INCLUDING MOTOR CONTROL GEAR

E.W.F. ELECTRICAL WHOLESALERS FEDERATION MEMBER

"Superior"

Sloan Electrical Co. Ltd.

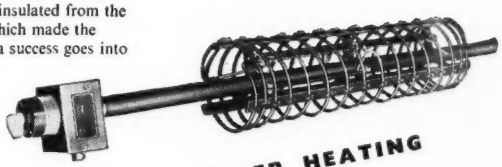
SLONETRIC HOUSE, BONDWAY, LONDON, S.W.8

Bristol, Ealing, Edinburgh, Exeter, Leyton, Manchester, Peckham, Truro

Making things hot for industry

When it's a question of quick, efficient heating the Metrovick tubular-sheathed heating element comes into its own. Its possibilities are almost unlimited and a few of its present applications are shown below. It can be bent into almost any required shape and the element sheath, which is available in a variety of materials, is insulated from the live spiral. The same skill and care which made the Metrovick domestic "Redring" such a success goes into every heating element for industry.

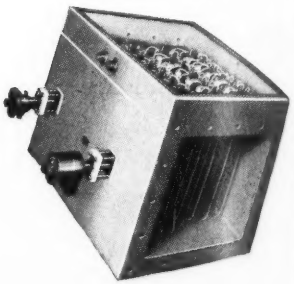
Send for Special Publication 7703/1.



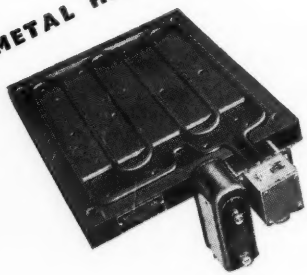
ROLLER HEATING

LIQUID HEATING

AIR HEATING



METAL HEATING



Metrovick
TUBULAR SHEATHED
Elements

METROPOLITAN-VICKERS ELECTRICAL CO. LTD., TRAFFORD PARK, MANCHESTER 17
Member of the A.E.I. group of companies

METROVICK *tubular sheathed heating elements for industrial use*

L/5203

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 18th March, from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1941

4426. Halban, H. H. von, Kowarski, L., Bretscher, E., and Feather, N.—Production of energy from radio-active materials. 10th December, 1941. (688821.) 11552. Energy-producing apparatus. 23rd June, 1942. (688822.)

1942

1162. Halban, H. H. von, Kowarski, L., Bretscher, E., and Feather, N.—Energy-producing devices. 23rd June, 1942. (688823.)

17850. Bauer, S. G., and Kowarski, L.—Energy-producing devices. 8th December, 1943. (688824.)

1947

68. Philips Lamps, Ltd.—Electrical condensers. 1st January, 1947. (Addition to 637376.) (688825.)

18844. Philips Electrical, Ltd., and Rothschild, S.—Preparation of luminescent materials. 14th August, 1948. (688895.) 23947.—Luminescent materials. 6th June, 1950. (688896.)

1949

20565. Standard Telephones & Cables, Ltd.—Railway signalling systems. 28th July, 1950. (689093.)

24209. Electric & Musical Industries, Ltd.—Manufacture of magnetizable iron oxide. 4th September, 1950. (688903.)

27352. Cathodeon, Ltd., and Theile, R.—Television pick-up tubes. 16th May, 1950. (688904.)

28283. Fillery, G. T.—Combined suction cleaning and floor polishing apparatus. 26th September, 1950. (689098.)

28360. Ashley Accessories, Ltd., Foxcroft, J. C. M., and Everitt, L. H. R.—Dolly-operated electric switches and switchgear. 6th November, 1950. (Cognate application 580, 10th January, 1950.) (688905.)

29589/0. General Electric Co., Ltd., Smith, F. C., and Leng, T. R.—Electrically heated incinerators. 20th November, 1950. (689099/0.)

1950

583. Ashley Accessories, Ltd., and Everitt, L. H. R.—Electric switches having a dolly or like pivoted operating member. 8th January, 1951. (688908.)

1251. Sonotone Corporation.—Thermionic valves. 17th January, 1950. (688910.)

2244. Thermionic Products, Ltd.—Electromagnetic transducers. 9th May, 1951. (689101.)

2831. Standard Telephones & Cables, Ltd.—Commutating mechanism controlled by cross-bars. 3rd February, 1950. (688835.)

NEXT WEEK'S EVENTS (*continued*)

Friday, 13th February

BIRMINGHAM.—T.I. Social Club, Oldbury. E.I.B.A. Birmingham Branch Area annual ball.

LIVERPOOL.—9, Whitechapel, 7.30 p.m. A.S.E.E. Liverpool Branch. "Electronics in Industry," by Mr. Hickman, lecture and sound film.

LONDON.—Savoy Place, W.C.2, 6.30 p.m. I.E.E. London Students' Section. Conversazione and dance.

Caxton Hall, Westminster, S.W.1, 6.30 p.m. E.P.E.A. Southern Meter Engineers' Group. "Testing of kWh Meters with Electrically-driven Stroboscope and Counters," by A. J. Baggott.

STOKE-ON-TRENT.—Copeland Arms Hotel, Glebe Street, 7.30 p.m. A.S.E.E. Crewe Branch. "A.C. Motors and Control Gear," by T. C. Riches.

4019. General Electric Co., Ltd., Humphrey, R., and Hunt, M. H.—Electric snap-action switches. 16th February, 1951. (688913.)

5789. Marconi's Wireless Telegraph Co., Ltd.—Film television apparatus. 9th February, 1951. (688840.)

6508. British Thomson-Houston Co., Ltd., and Raby, K. F.—Polyphase heteropolar inductor alternators. 23rd February, 1951. (689045.)

9484. British Insulated Callender's Cables, Ltd.—Manufacture of metal tubes applicable in some cases as electric conductors or other parts of electric cables. 18th April, 1951. (688973.)

9759. Ferguson Electro Mechanical Developments, Ltd.—Hair dryer. 20th April, 1951. (689106.)

10945. General Electric Co., Ltd., and Miles, E. E.—Low-pressure electric discharge lamps. 9th April, 1951. (688920.)

11011. Allday & Son (1922), Ltd., H., and Bain, R.—Flush-mountable wall box for an electric switch, fuse, socket, connector, or other electrical accessories. 24th April, 1951. (688844.)

11073. Angerby, E. A.—Electrical switching devices particularly cross-bar switches. 4th May, 1950. (688922.)

12606. Compagnie Générale de Télégraphie sans Fil.—Travelling-wave apparatus. 19th May, 1950. (688925.)

13057. General Electric Co., Ltd., Jenkins, H. G., and Woolgar, A. E.—Bi-pin adaptors for electric bayonet caps or plugs. 3rd May, 1951. (688926.)

13506. General Electric Co., Ltd., and McKeag, A. H.—Luminescent materials. 17th May, 1951. (688927.)

14454. General Electric Co., Ltd., and Hubbold, S.—Electric sockets adapted to co-operate with two-pin lamp caps. 9th April, 1951. (688928.)

14798. Electroflo Meters Co., Ltd., and Hardy, R.—Electrical signalling systems. 7th June, 1951. (689108.)

16763. Rotax, Ltd.—Electrical switching apparatus for controlling a plurality of circuits in sequence. 29th June, 1951. (688848.)

17473. British Thomson-Houston Co., Ltd.—Dish-washing apparatus. 12th July, 1950. (Addition to 681911.) (688849.)

19223. White-Ibbotson, Ltd.—Control of cathode-ray tubes. 26th July, 1951. (Cognate application 22556, 13th September, 1950.) (688857.)

21095. Thompson & Co. (Sunbury), Ltd., R. E., and Benford, P. R.—Control mechanism for temperature-sensitive or pressure-sensitive actuating devices, particularly for thermostatic electric switches. 21st August, 1951. (688936.)

21123. General Electric Co., Ltd., and Halliday, D.—Laminated magnetic cores for single-phase transformers. 11th May, 1951. (688861.)

21382. Grant, A. K.—Variable electric condensers. 30th August, 1951. (689061.)

23810. General Electric Co., Ltd.—Electric pulse modulation signalling systems. 6th September, 1951. (688938.)

24766. Compagnie Générale de Télégraphie sans Fil.—Travelling wave tube. 10th October, 1950. (689063.)

24865. Marconi's Wireless Telegraph Co., Ltd.—Supporting mounting arrangements for large air cooled thermionic valves. 4th June, 1951. (689064.)

25516. General Electric Co., Ltd., Douglas, R. W., and Lindell, A. O. E.—Crystal rectifiers. 25th September 1951. (688866.)

26142. British Thomson-Houston Co., Ltd.—Dish-washing apparatus. 26th October, 1950. (688939.)

26457. Siemens-Reiniger-Werke Akt.-Ges.—Betratons, more particularly for medical irradiation. 30th October, 1950. (688940.)

27307. British Thomson-Houston Co., Ltd., and Wells, R. S.—Method of producing a luminescent material. 10th October, 1951. (688942.)

30444. British Thomson-Houston Co., Ltd.—Temperature responsive control mechanisms. 13th December, 1950. (689069.)

30662. Welding Research, Inc.—Three-phase welding systems. 15th December, 1950. (688874.)

30893. Southern United Telephone Cables, Ltd.—Circuit arrangement for electric testing. 18th December, 1951. (688988.)

30921. Bonochord, Ltd.—Hearing devices. 11th October, 1951. (689133.)

30996. English Electric Co., Ltd.—Cable end identification ferrules and the like. 14th December, 1951. (688990.)

31050. Mond Nickel Co., Ltd.—Electrical storage batteries. 18th December, 1951. (688991.)

31124. Rothermel, Ltd., and Paul, G. M.—Electromechanical transducers. 13th December, 1951. (688993.)

31255. Evershed & Vignoles, Ltd.—Electrical measuring instruments. 20th December, 1951. (688995/6.)

31384. British Thomson-Houston Co., Ltd.—High-tension inductive windings for electrical apparatus. 14th December, 1951. (688875.)

1951

205. Needle Industries, Ltd.—Electric furnaces for the heat treatment of metal articles. 20th December, 1951. (688998.)

1130. Thorn Electrical Industries, Ltd.—Methods of phosphor manufacture. 15th January, 1951. (688947.)

1401. British Thomson-Houston Co., Ltd.—Magnetic-fluid clutches. 18th January, 1951. (689138.)

1614. Etablissements Merlin & Gerin.—Flameproof electrical apparatus. 22nd January, 1951. (688948.)

2788. Plessey Co., Ltd.—Potentiometers or resistor elements. 20th December, 1951. (689001.)

3878. Siemens & Halske Akt.-Ges.—Multiplex pulse signalling systems. 16th February, 1951. (689140.)

5234. Chloride Electrical Storage Co., Ltd.—Primary and secondary electric batteries. 17th December, 1951. (689003.)

5977. Westinghouse Electric International Co.—Electrical induction apparatus. 13th March, 1951. (689077.)

6153. Loewe Opta Akt.-Ges.—Magnet system arrangement for magnetic sound carriers. 14th March, 1951. (689144.)

6042. British Thomson-Houston Co., Ltd.—Liquid-immersed apparatus. 13th March, 1951. (688952.)

9054. British Insulated Callender's Cables, Ltd.—Manufacture of seamed tubing. 18th April, 1951. Cognate application 27352, 8th November, 1950. Divided out of 688973.) (689007.)

10490. Philips Electrical Industries, Ltd.—Radio transmission systems. 4th May, 1951. (689082.)

12606. Scintilla, Ltd.—Magneto-electric machines. 29th May, 1951. (689083.)

12714. Standard Telephones & Cables, Ltd. (Matériel Téléphonique Soc. Anon.).—Thermionic cathodes. 30th May, 1951. (688956.)

13884. Ateliers de Constructions Electriques de Charleroi.—Magnetic sound recording apparatus. 12th June, 1951. (688880.)

15497. British Thomson-Houston Co., Ltd.—Electric contact converters. 29th June, 1951. (688958.)

17033. General Motors Corporation. Key-operable electric switch. 18th July, 1951. (688886.)

20403. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Target electrodes for television camera tubes. 29th August, 1951. (688959.)

21296. Metropolitan-Vickers Electrical Co., Ltd.—Temperature control devices. 10th September, 1951. (689089.)

21882. British Thomson-Houston Co., Ltd.—Rotor laminations and iron-cobalt alloys therefor. 18th September, 1951. (688889.)

22578. Pirelli-General Cable Works, Ltd., Arman, A. N., and Ashford, B. O.—Fluid-filled electric cables. 20th December, 1951. (689013.)

23823. Philips Electrical Industries, Ltd. Methods of preparing grids for electric-discharge tubes. 12th October, 1951. (688960.)

29611. British Thomson-Houston Co., Ltd.—Insulating structures and method of assembling same. 18th December, 1951. (689020.)

29756. British Thomson-Houston Co., Ltd.—Refrigerators. 19th December, 1951. (689021.)

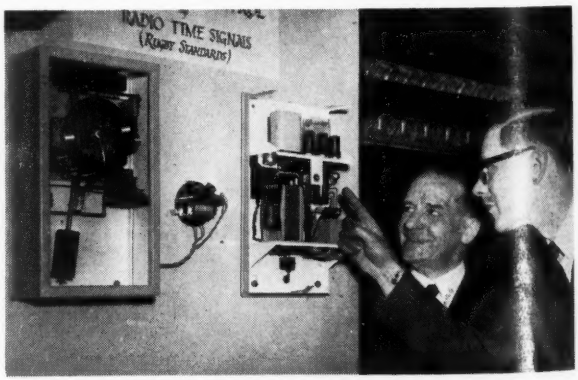
29874. British Thomson-Houston Co., Ltd.—A.c. volt-ampere meters. 20th December, 1951. (689024.)

1952

9226. Standard Telephones & Cables, Ltd.—Cross-bar selector switches. 3rd February, 1950. (Divided out of 688835.) (688890.)

Radio-Controlled Clock

A CLOCK controlled by radiated time signals was on view among exhibits demonstrated by the Horological Institute at the Goldsmiths' Hall in London recently. Mr. S. J. Smith, of the T.M.C. organization, developed the clock mechanism whose accuracy can, it is claimed, be made absolute. Should the clock's pendulum tend to swing out of phase it will be brought back to its right order of swing periodically by the time signals radiated from Rugby.



Mr. S. J. Smith (left) with Mr. J. K. Langham, who was responsible for the electronics side of the development

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Bedlington.—24th February. U.D.C. Electrical goods and cable requirements for one year. A. K. Dennis, surveyor, Council Offices, Front Street, Bedlington.

Cleethorpes.—20th February. Corporation. Lighting installation at Pier Pavilion. (See this issue.)

Enfield.—20th February. Group Hospital Management Committee. Electric lamps for one year. Supplies officer, Chase Farm Hospital.

Horwich.—17th February. U.D.C. Electric lamps (tungsten and sodium), for one year. T. Roscoe, clerk, Council Offices.

India.—NEW DELHI.—16th February. Director General, Supplies and Disposal. Supply of 816 iron clad lead acid cells (150 Ah capacity) for train lighting. (C.R.E. 4085/53. Ten/5651.)*

New Zealand.—WELLINGTON.—3rd March. Post and Telegraph Department. Lead-acid secondary batteries and accessories. (C.R.E. 3263/53. Ten/5590.)*

16th April. State Hydro-Electric Department. Suspension and strain strings of insulators. (C.R.E. 3264/53. Ten/5591.)* 22nd April. Steel cored aluminium transmission line conductor and accessories. (C.R.E. 3262/53. Ten/5592.)*

Romford.—Traffic signals equipment. (See this issue.)

Stockport.—26th February. Corporation. Lanterns, chokes, capacitors and time switches. (See this issue.)

Tynemouth.—23rd February. Borough Council. Electric lamps, cable, lamp columns and reflectors, for one year. D. M. O'Herlihy, borough surveyor, 16, Northumberland Square, North Shields.

West Riding.—23rd February. County Council. Conversion from gas to electrical installation at Selby County Senior and Junior Mixed School. (See this issue.)

ORDERS PLACED

Birmingham.—Regional Hospital Board. Recommended. Rewiring Selly Oak Hospital (£3,920).—Midland Electricity Board. Rewiring Dudley Road Hospital (£2,654).—F. H. Wheeler & Co., Ltd.

Bradford.—City Council. Work in connection with electrical installations in 232 houses and flats on the Buttershaw housing estate (£6,348).—Shann & Bell, Ltd.

Newcastle-on-Tyne.—Regional Hospital Board.—Electrical installation in the geriatrics unit at Carlisle City General Hospital (£3,948).—G. Bowman, Ltd., Carlisle.

Norwich.—Education Committee.—Electrical installation work at Lakenham Secondary Modern Girls' School (£6,657).—Mann, Egerton & Co.

Stockport.—Corporation. Recommended. Electrical installation work at Brinnington Estate Primary School (£1,716).—Piggott & Whitfield.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aldridge.—Houses (34), Leighswood estate, for U.D.C.; Sabin & Young, Pelsall Lane, Rushall.

Birmingham.—Extensions for Jones & Rooke, Ltd., Northwood Street; F. S. Wrigley, architect, 66, Corporation Street, Birmingham.

Slipper baths (£40,000), Heath Street, Winson Green; H. J. Manzoni, city engineer.

Blackburn.—Proposed municipal washhouse with electrical washing machines, Belper Street; borough engineer.

Stage 1 of new technical college; Willink & Dodd, architects, Cunard Buildings, Liverpool.

Bredbury and Romiley.—Houses (264), Goyt Valley and Mill Lane estates, for U.D.C.; W. Thorpe & H. Hirst Smith, architects, 65, Barton Arcade, Deansgate.

Carlisle.—Additional storeys to factory; Carr & Co., Ltd., Caldewgate.

Cheltenham.—Factory, Bouncers Lane; M. & H. Godden, Stanley Works, Hewlett Road.

Cheshire.—Grammar school, Bruntwood, Cheadle, and secondary school at Hazel Grove. E. M. Parkes, county architect, The Castle, Chester.

Chesterfield.—Two infants' schools; Wilcockson & Cutts, architects, 12, Saltergate.

Coventry.—Departmental store, Broadgate; Marks & Spencer, Ltd., 72, Baker Street, W.1.

Croydon.—Works extensions; Creed & Co., Ltd., Telegraph House.

Dagenham.—Factory, Hainault Industrial estate; Ascott Precision Tool Co., Ltd., 20, Wilmot Road, E.10.

Deal.—Houses (118), Balfour Road estate; D. A. Daniels, town clerk, Queen Street.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

Derbyshire.—Ambulance stations for County Council at Ripley (£11,600); Bakewell (£7,000) and Bolsover (£8,000); county architect, Derby.

Fire stations at Chesterfield (£40,000), Alfreton (£16,000), Eckington (£16,000), Clay Cross (£21,000), and Bradwell (£16,000); County architect.

Clinic at Clowne (£20,000); county architect.

Devizes.—Houses (128), Drake's Farm site; J. D. Sheasby, borough surveyor, Town Hall.

Doncaster.—College of further education; A. J. Smith, electrical consultant, 70, Wigmore Street, W.1.

Dorking.—Development of estate at North Holmwood, with provision for over 500 houses, etc.; U.D.C. surveyor, Council Offices, Pippbrook.

Durham.—Additions to Houghall Farm School (£11,000); county architect, Court Lane, Durham.

Ealing.—New laundry building at the Central Baths; E. J. Cope-Brown, town clerk, Town Hall, W.5.

Eastbourne. — Extensions to the Winter Gardens; Easton & Robertson, architects to T.C., Bedford Square, London, W.C.1.

Fareham.—Houses (41), Barnes Lane, Sarisbury; U.D.C. surveyor, Westbury Manor, Fareham, Hants.

Gosforth (Northumberland). — Houses (110), Regent Farm estate, for U.D.C.; C. Wyld, surveyor.

Hatfield.—Houses (139), for Development Corporation; Brett & Boyd, architects, New Town House.

Hebburn (Co. Durham).—Community centre in Crawley Square for U.D.C.; surveyor, Council Offices.

Hull.—Factory and offices, Blackfriargate; Robinson & Speight, Ltd., Osborne Street.

Kingston-on-Thames. — Hostel, etc., at Gipsy Hill Training College (£51,840); Surrey county architect.

Knaresborough.—Houses (83), on the Manor estate; F. Tranmer, architect to U.D.C., 3, Victoria Avenue, Harrogate.

Lewes.—Bus garage, administrative buildings, etc., on site near Eastgate Street, for Southdown Motor Services, Ltd.; Ringmer Building Works, Ltd., builders, Ringmer, East Sussex.

London. — Deptford. — Extensions; J. H. Robinson, Ltd., Deptford Bridge Flour Mills, S.E.8.

Waterloo. — Reconstruction of warehouse, Great Guildford Street, S.E.1 (£112,000), for Frank Love, Ltd., plumbers' brassfounders; A. Cooksey & Partners, architects, 19, Garrick Street, W.C.2.

Lowestoft.—Works extensions; Birds Eye Foods (Great Yarmouth), Ltd., Rant Score.

Manchester.—Factory at Worsley; British Oxygen Co., Ltd., 24, Grafton Street, London, W.1.

Middlesbrough. — Houses (52), Park End housing site; borough engineer.

Morecambe and Heysham.—Houses and flats (56), on sites in Smithy Lane and at rear of Tomlinson Road; R. Rose, town clerk, Town Hall.

Morpeth.—Houses (60) at Longhirst Colliery for N.C.B.; Architects' Department, Ashfield Tower, Newcastle-on-Tyne.

Netherton (Dudley).—Works extensions; J. Barnsley & Sons, Ltd., pulley block manufacturers, Netherton, Cradley Heath.

North Shields.—Offices and canteen, Norham Road, for North Tyneside Co-operative Bakeries, Ltd.; C.W.S. Building Department, West Blandford Street, Newcastle-on-Tyne.

North Witchford (Cambs). — Dwellings (48), Doddington and Wimblingdon; Council's architect.

Norwich.—Houses (127), on two estates; H. C. Rowley, city engineer, City Hall.

Salford.—Grammar school (work to commence in summer); Taylor & Young, architects, Oxford Road, Manchester.

Scunthorpe.—Junior school, Priory Lane, Ashby; Lindsey county architect, Lincoln.

Seaham. — Houses (100), Westlea estate; A. M. Smith, U.D.C. surveyor, Cliff House, Seaham.

Shardlow.—Houses (216), on four sites; J. H. Clark, surveyor, Rural Council Offices, Full Street, Derby.

Sheffield.—Construction of new maternity unit at Rutland Memorial Hospital; Morton & Potter, Ltd., Barkley Road, Leicester.

Smethwick. — Extensions at Holly Lodge Girls' Grammar School; G. Randle & Son, architects, 116, High Street.

Southampton. — Factory, Millbrook estate; Skinners (Redbridge), Ltd., 30, Coniston Road.

Stafford.—Extensions for Universal Grinding Wheel Co., Ltd. (£200,000).

Stowmarket.—Houses (100) on the Chilton estate; R. A. Bailey, clerk to U.D.C., Council Offices, Ipswich Road.

Sunderland.—Shops with 14,000 sq ft floor space; William Pickersgill & Sons, Ltd., shipbuilders, Sunderland.

R.C. church on the Springwell estate (£15,000); Reavell & Cahill, architects, Lloyds Bank Chambers, Alnwick.

Surbiton.—Factory, Cox Lane and Davis Road; H.S.S., Ltd., Bittoms Yard, Kingston-on-Thames

Swindon. — Houses (68), Penhill estate; borough architect.

Swinton and Pendlebury. — Proposed extensions to library; U.D.C. surveyor.

Tottenham.—Belmont Junior School, Belmont Road; borough engineer.

Wakefield. — Adaptations at Stanley Royd Hospital; Rd. Mellor, architect, Park Parade, Harrogate.

Whitehaven.—Civic hall; W. H. J. Browne, town clerk, Town Hall.

Wigan. — Houses (100), Worsley Mesnes estate; borough surveyor, Municipal Buildings, Library Street.

Wigston (Leics).—Proposed shops, Central Avenue and Clarkes Road estate; U.D.C. architect.